The Archaeology and Conservation of the East Front of York Minster

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ABSTRACT

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This thesis explores the archaeology of the East Front of York Minster and considers the ways in which an enhanced understanding of the cathedral fabric can inform and support its ongoing conservation. Through a detailed synthesis of archival sources alongside close analysis and recording of the standing fabric, this research not only examines previous hypotheses on the medieval evolution and significance of the façade, but also sheds valuable new light on its post-medieval repair history. Since the repair histories of cathedrals are generally poorly represented in current scholarship, this thesis therefore makes a substantial contribution to the field of church archaeology and the understanding of the history of the Minster in general.

In considering the ways in which archaeological research can contribute to the conservation of the façade, this thesis argues that, if closely aligned with the needs of the building and the Quinquennial Inspection regime, a thorough understanding of the history of the fabric can directly shape both the philosophical and practical approaches to repair. The value of dialogue and debate between practitioners is revealed and emphasised, as is the potential for significance-led conservation to not only aid the conservation of stone *in situ*, but also to support and inform the opportunities to renew. Importantly, this enables both the conservation of the design of the cathedral, as well as the traditional craft skills and technologies which are necessary to maintain it.

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AUTHOR'S DECLARATION

I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

‘Archaeology proper has never harmed architecture’

(Powys 1937, 42)

CHAPTER 1

BUILDINGS ARCHAEOLOGY AND THE EAST FRONT OF YORK MINSTER ~ *The research context*

1.1 Introduction

York Minster is a building of international significance and stature (Figure 1). Recognised as the largest Gothic cathedral in Northern Europe, its physical fabric captures an evolving story of medieval Christianity and architectural expression that has captivated scholars for centuries. However, the history and significance of the fabric is not confined to the medieval period, and neither to its stylistic evolution. Time and decay have seen the exterior routinely repaired, while catastrophic fires, structural crises and changing religious attitudes have led to frequent refurbishment, intervention and re-arrangement of the interior throughout the modern period. This cumulative archaeology, embodied in the fabric of the building and enhanced by documentary sources, remains largely unexplored and undervalued, despite the fact that it has the potential to cast new light on the Minster's much-debated past. Therefore, through the lens of the discipline of 'buildings archaeology', this thesis sets in motion a challenge to this shortfall in understanding. Through a process of archival research and fine-grained building analysis, it re-examines the evolution and significance of one of the primary elevations of the building – the East Front (Figure 2).

Constructed in the 1360s, the East Front forms an architectural framework for the Minster's internationally acclaimed Great East Window. The importance of the medieval glazing of this window has long been acknowledged by scholars (e.g. Gent 1762; French 2003; Brown 2003; Norton 2005), yet the history and significance of the associated stonework has, comparatively speaking, received far less attention. Fortunately, however, the initiation of a major programme of repair on the façade since 2005 has lead to a renewed focus upon its

archaeology and meaning, and a desire to establish its significance in order to inform the conservation process. The full scaffolding of the elevation ahead of repair provided a unique opportunity to examine the elevation from an archaeological perspective, and this became the focus of a successful research bid to the Arts and Humanities Research Council (AHRC). As this thesis will show, by confining investigation to the East Front alone it has been possible to pay closer attention to the minutiae of construction and repair that would normally lie beyond the scope of conventional architectural history. Increasingly, however, the coincidence of the research agenda with an active repair programme has also revealed an unprecedented chance to question the broader role of buildings archaeology in the conservation of York Minster, and its potential contribution to the process of conservation more generally.

1.2 Buildings archaeology, church archaeology and the conservation of cathedrals

Buildings archaeology has continued to emerge as a distinct branch of archaeology throughout the past twenty years. Its development is closely aligned with, and complimentary to, the continually evolving approaches to the conservation of historic buildings (Wood 1994; Clark 2001a; 2001b; Grenville 2001; Sampson 2006; Heaton 2009). This process of conservation includes the care of ecclesiastical sites, which has been facilitated by a close antecedent of buildings archaeology – church archaeology – throughout the past two centuries (Rodwell 1989; Morris 1996). The purpose of this section, therefore, is to outline the growth of buildings archaeology and its close relationship with church archaeology, and how the two disciplines are embedded within the development of modern conservation principles that are directly relevant to the care of York Minster in the present. Importantly, this section will also raise new questions relating to the wider implementation of archaeological analysis in practice, which shape, and account for, the agenda that lies at the heart of this research.

In its simplest form, buildings archaeology is the recording and analysis of the physical fabric of a building in order to understand its development through time. The underlying desire to enhance the understanding of the history of a building may be manifold, but in conservation it is currently led by the aim to establish significance, either of the building as a whole or its constituent parts (Clark 2001a; 2001b; Heaton 2009, 134-135). This aim is built upon the perception that conservation is the management of change (English Heritage 2008, 22). Therefore, for change to take place responsibly its impact on what is important about a building should at first be ascertained through an understanding of its significance and value.

As with all developing disciplines, it has become customary for writers on buildings archaeology to routinely attempt to define its identity, aims and methods (e.g Wood 1994; Grenville 2001). In its commercial application, Heaton (2009) views the archaeological investigation of buildings as an extension to building pathology, and demonstrates its proactive contribution to the sensitive alternation of listed buildings. In a similar way, Chitty (1992, 294) has also commented on the direct value of building analysis in the conservation process through its ability to closely identify past interventions which may have lead to an alteration of a building's fabric. On the question of appropriate methodologies, Ferris (1989) has suggested that the archaeological investigation of buildings should focus on detailed data-gathering to achieve greater objectivity in the process of recording. Others, such as Smith (1989, 20) and Grenville (1997, 2), have disagreed, placing emphasis on the framing of clear research aims as a precursor to selective investigation. However, irrespective of the debates on suitable approaches, there can be no doubt that buildings archaeologists as a group have become preoccupied with a desire to distance themselves from art and architectural history, or at least question their associations (e.g. Morrice 1992; Sampson 1998, xi). While the subtlety of opinion inevitably varies, the general view has been that architectural history has tended to focus more on style and aesthetics, and less on construction, materials and recording (Ferris 1989, 12; Morriss 2000, 10; Heaton 2009, 121).

In conservation this has been seen as a particular drawback, because analyses based on style have presented buildings as intended, rather than as found.

However, as recurrent (and often oversimplified) as the conflict between buildings archaeology and architectural history may be, this issue has been of less explicit concern to an important branch of archaeology that more appropriately represents the theoretical and methodological tenor of this thesis – church archaeology. This field of study focuses explicitly on the investigation of the fabric of ecclesiastical buildings and has been examined at length by Addyman and Morris (1976), Morris (1983) and Rodwell (1989), which has become the standard work. Crucial to its outlook is its willingness not to discriminate between forms of evidence related to a building and the perceived values of its constituent parts, but instead to view the site as a collective accumulation of the past. The examination of documentary evidence forms an important mode of analysis alongside the careful holistic recording and stratigraphic analysis of the fabric, be it above or below ground (Rodwell 1989, 15; Grenville and Morris 1992, 301). The net aim is to better understand the entire life of the building through its chronology and associated history, the modes of construction used and the materials employed. Importantly, and of direct relevance to this thesis, the practice of church archaeology has fundamentally revised the understanding of many churches and cathedrals and openly recognises the need to extend close analysis into the more recent past (Gilchrist and Morris 1996; Rodwell 1996a, 200). Indeed, to quote Rodwell (1996b, 90) 'the post-medieval archaeology of British cathedrals is a virtually untouched field'. This statement remains as true now as when it was made over fifteen years ago.

Church archaeology has generated an academic arena in which research questions can be raised at their own pace (e.g. Blair and Pyrah 1996; Tatton-Brown and Munby 1996). Crucially, however, it is also now seen as an essential component in the maintenance of cathedrals through the *Care of Cathedrals Measure* (Gem 1996; Rodwell 1996b, 201), with the conservation of the west fronts of the cathedrals of Wells and Salisbury now standing as models of its

application in practice (Rodwell 1996c; Sampson 1998; 2006; Ayers 2000; Drury and Burman 2006, 28-29). In the case of church archaeology's relationship with conservation, this is not a new concept. Instead, it should be seen more simply as the formalisation of an activity that actually has a much longer association with the treatment of historic buildings. This is worth exploring further, as it helps to explain the attitudes towards conservation today, and the belief that archaeological investigation, be it of ecclesiastical or secular buildings, is a necessary precursor to change.

The terms of church and buildings archaeology have been coined only relatively recently (Rodwell 1989 13; Morriss 2000, 10). However, their mutual pedigree can be traced well into the nineteenth century, when the elements of church archaeology grew hand-in-hand with the rapidly changing attitudes towards the treatment of historic buildings (Rodwell 1989, 22-26; Mason and Shacklock 1995; Jokilehto 2005, 106-112; Drury 2006, 33-36). At this date, medieval churches and cathedrals were a principal focus of attention of both eminent scholars and ambitious architects. By the end of the eighteenth century individuals had already become absorbed in the rediscovery of Gothic architecture in response to its post-medieval deposition at the hands of Classicism. As knowledge and appreciation of Gothic structures grew, programmes of heavy-handed repair and spatial rearrangement were increasingly condemned as antiquarians such as Richard Gough and John Carter began to place historical and artistic value on the material remains of the past (Jokilehto 2005, 106). The inquisitiveness of antiquarians gathered pace, and the early years of the nineteenth century saw the continued publication of accurate building surveys of cathedrals accompanied by historical narratives. The production of these discourses climaxed in the middle of the century, of which the authoritative works of Professor Robert Willis are still capable of withstanding even the most rigorous criticism today (Rodwell 1989, 26; Thompson 1996).

By the 1840s the close analysis of medieval Gothic was also being used to inform and justify the widespread restoration of churches and cathedrals

(Rodwell 1989, 22). Driven by an increase in religious fervour led by the Cambridge Camden Society (later the Ecclesiological Society), these stylistic restorations stepped well beyond the traditional bounds of repair and maintenance in an attempt to resurrect the church in its purest form, irrespective of its evolution over time (Jokilehto 2005, 156-157). Although many buildings were saved from neglect in the process of these restorations, the consequence was the widespread alteration of many churches and cathedrals. Great façades and towers were rebuilt to new designs, statuary was replaced, and interiors were cleared and refurbished. The response to this was far reaching, and laid the foundations for modern conservation thought and the motives for the archaeological investigation of buildings which exist today.

Central to the anti-restoration movement were the views of John Ruskin (1819-1900), who saw the reproduction or falsification of work on a medieval building as a destructive act that eroded both its historical authenticity and the opportunity for true artistic expression (Jokilehto 2005, 174; Mason and Shacklock 1995, 9). The enriched awareness of medieval buildings that had been gathering through the first half of the nineteenth century was now an active force in the argument for retaining the physical fabric in order to protect its medieval values. The debates that followed saw the moderation and decline of speculative restoration, and, in tandem, the gradual tailing off of the archaeological study of churches and cathedrals into the early 1900s (Rodwell 1989, 25). However, the broad tensions between retention and renewal remained, with the like-for-like repair of buildings now as controversial as stylistic restoration had once been. Furthermore, the historic building stock as a whole was now deemed increasingly worthy of protection (Jokilehto 2005, 185).

Ruskin's ideas were inherited by the Society for the Protection of Ancient Buildings (SPAB), formed in 1877, whose *Manifesto* forms the bedrock of modern conservation policy (Earl 2003, 61-64, 156-159; Jokilehto 2005, 185; Burman and Drury 2006, 28). Importantly, this document views buildings as

collective documents of the past that merit protection because they encapsulate culturally significant values:

'If… it be asked us to specify what kind of amount of art, style, or other interest in a building, makes it worth protecting, we answer, anything that which can be looked on as artistic, picturesque, historical, antique, or substantial.'

SPAB Manifesto (1877) in Earl (2003, 158)

The definitions of these values would later evolve, but the plea to protect buildings with their significance in mind has not. The twentieth century has seen the production of numerous charters, standards and publications, all of which have sought to lay down a code of practice for the appropriate treatment of historic buildings. These developments were to parallel the resurgence in the archaeological investigation of buildings, with the major development of both fields having been prompted by large-scale redevelopment in the wake of World War Two (Rodwell 1989, 30). Superseding the *Athens Charter* of 1931, the *Venice Charter* was published in 1966 having been approved at a Congress of Architects and Specialists in Historic Buildings (Earl 2003, 161; Burman and Drury 2006, 28). The charter places strong emphasis on the multi-disciplinary understanding of historic monuments to preserve the values embodied within their materials, and Article 9 demands that archaeological and historical study of the monument should be undertaken before any intervention takes place (Venice Charter (1966) in Earl 2003, 162). Critically, this Charter was to nurture the concept of protecting the historic *authenticity* of a monument through the preservation of its materials wherever possible. The question of authenticity remains highly influential in conservation, and has informed both national and global practice (Brereton 1991, 8; Nara Document on Authenticity 1994).

Further adaptations of the Venice Charter were to follow, including the *Burra Charter* of 1979 (with subsequent revision in 1981, 1988 and 1999). Importantly, the Burra Charter was less restrictive in its outlook, advocating a 'cautious approach to change' (Burra Charter 1999 in Earl 2003, 166). More importantly, however, it introduced the concept of identifying and protecting

cultural significance as the *foundation* of conservation policy through the formation of conservation plans, which has since been inherited by all subsequent guidance. Most recently in the UK, this has taken the form of English Heritage's (2008) *Conservation Principles.* According to Principle 4 of this guidance, conservation is the management of change, rather than a resistance to it, with this change supervised through the accurate assessment of the values associated with the building or place (English Heritage 2008, 22). These core values are defined as evidential, historical, aesthetic and communal, and serve as a broad structure in which to investigate and present the significant aspects of a site (English Heritage 2008, 28-32). Though set in a language designed to fit today's view of conservation, the acknowledgement that these principles owe to the SPAB *Manifesto* is undeniable. Furthermore, the close relationship between the current principles and the aims of the SPAB may also account for the less favourable perception that buildings archaeology is opposed to the restoration and alteration of historic buildings by default (Giles 2010 forthcoming).

In modern practice the relationships between investigative techniques, significance and conservation have been succinctly brought together in Clark's (2001a) textbook *Informed Conservation.* This key policy document brings the techniques of buildings archaeology within the remit of CoBRA (Conservation-Based Research and Analysis), which describes 'the research, analysis, survey and investigation necessary to understand the significance of a building and its landscape and thus inform decisions about repair, alteration, use and management' (Clarke 2001a, 9). As Figure 3 shows, CoBRA is placed at the very beginning of the conventional conservation process as a precursor to change, rather than towards the end as a purely mitigating activity in the face of loss. Within Stage 1, CoBRA appears in the form of a rapid assessment or conservation plan from which the perception of the impact on the building's significance will be drawn. However, while CoBRA is seemingly represented early on, a more critical consideration of this framework shows that the role of detailed recording and analysis is not quite as prominent, nor utilised, as one might expect. In fact, the core elements of CoBRA appear at Stage 2 – when, by this time, the direction of the project has already been laid down in response to

either the rapid assessment or conservation plan. By their very nature these forms of guidance rarely involve new or in-depth research and analysis in their formation, and in some cases they may not exist at all. As a consequence, the potential for close analysis to influence decisions is greatly reduced. Instead of underpinning and creating the options for conservation, the information gained at Stage 2 merely adjusts them. The knock-on effect of this can be seen English Heritage's (2006) *Understanding Historic Buildings: a guide to good practice,* which prescribes the Levels of Record required in response to the nature of a predetermined intervention (English Heritage 2006, 16). This sustained 'loophole' in what might normally be accepted as the model conservation process is essential to bear in mind, as it provides a context for the manner in which buildings archaeology and informing conservation has so far been perceived and implemented at York Minster.

Before concluding, it is also important to note the responses amongst practitioners to these codes of ethics and principles, for they remain as relevant in the present as they did during the formation of the conservation movement. While it can be said that those involved in the care of historic buildings at the end of the nineteenth century were sympathetic to the notion of protecting the physical fabric of a building, criticism emerged that, as noble as these sentiments were, they did not offer any alternative practical solutions to repair (Mason and Shacklock 1995, 14). This view extends into recording and analysis, and is as prevalent today as it was in 1900. A recent paper by Yeomans (2007) has criticised the lack of attention that the English Heritage (2008) principles pay to understanding and maintaining the technologies of buildings and the practical demands of conservation, which can lead to unfortunate conflicts between intention and practice. In Yeomans' (2007, 18-19) view, the over-emphasis on understanding values has overlooked buildings as technologies, with the preservation of history through material retention taking place at the expense of structural integrity and design, as well as traditional craft skills. In the context of masonry buildings, this opinion is mirrored by Hill and David (1995, 217) who believe that 'conservation is an academic solution to a very practical problem'. This tension will be revisited later in this thesis, again

because it is pivotal in the way that buildings archaeology and conservation at the Minster has been valued and perceived in the past.

In sum, the philosophical and ideological framework of conservation provides an unquestionable context for the need to investigate before intervention. The rise of buildings archaeology is intimately bound with church archaeology, which itself formed a crucial component in the evolution of modern conservation principles. The strengthening recognition of the value of historic buildings in the eighteenth and nineteenth centuries spawned an increasing call for their protection, with the understanding and retention of their physical fabric central to the debate. By the end of the nineteenth century a suite of principles in the form of the SPAB *Manifesto* were in place, and have since informed all other guidance. After an interregnum of the first half of the twentieth century, the redevelopment that followed the Second World War prompted both a reconsideration of these principles and, in the case of ecclesiastical buildings, the regrouping of church archaeologists. Since then, guidance and practice have continued to evolve, but the underlying theoretical aim has remained constant – to better understand what we are trying to conserve.

In practice, however, a legacy of questions still remains. Detailed research and analysis, which enhances the understanding of significance, remains as an adjunct to the conventional conservation process. After the preliminary significance of a building is acknowledged, subsequent investigation is specified by the nature and extent of the intended intervention, rather than preceding the conservation design and serving to shape it. Therefore, this thesis intends to challenge this convention by demonstrating that a programme of longer-term research allows a much greater understanding to emerge that can more proactively support the approach to repair. In doing so, it will also confront the perception that a regard for conservation principles and the archaeology of a building does not offer any practical solutions to material problems.

1.3 The problem – magnesian limestone and the East Front of York Minster

'In time and with water, everything changes' (Leonardo da Vinci)

The need to investigate and conserve a building is brought about by change. In the case of buildings built of natural stone, the changes induced by the processes of weathering remain both constant and inevitable. Yet despite this perceived inevitability, attempts to understand and mitigate these processes continue to dominate conservation scholarship (e.g. Siegesmund et al 2002; Henry 2006; Přikryl and Smith 2007; Ashurst and Dimes 2008; Smith et al 2010). This is because the physical fabric of a building is arguably the most conspicuous reminder of its past, with the desire to protect the historic authenticity of a building paramount. Buildings made from sedimentary limestones not only receive considerable attention in the literature because of their distinctive aesthetic value, but also because this group of stones are renown as being prone to weathering. Amongst these stones is a specific type of limestone that is perceived as being especially vulnerable to decay – magnesian limestone. It is this stone that was used for building and repairing York Minster for centuries, and is a situation that continues to dictate the appearance and treatment of the building today.

Magnesian limestone is composed of both calcium carbonate and magnesian carbonate, which is usually present as the mineral dolomite (Hart 2007, 1). Its local availability twinned with its finely-grained texture, workability and attractive colour made it the ideal stone of choice for the medieval builders. Unfortunately, however, it has long been recognised that magnesian limestones can suffer the extreme effects of weathering through wind and rain erosion and salt-led decay associated with atmospheric pollution (Warnes 1926, 153-154; Cooke and Gibbs 1993, 5-9; Schaffer 2004, 37). Black crusts of sulphation deposits are liable to form in sheltered zones, beneath which the disruption of the stone occurs through the cyclical crystallisation of deliquescent salts and the formation of hollows and cavities (Figures 4-6). In the case of York Minster,

its richly ornamented exterior has rendered it especially prone to these processes of decay (Figure 6). This has meant that substantial amounts of the exterior fabric have required repair in the past, establishing a culture of stone replacement supported by major fundraising campaigns that can be documented into at least the nineteenth century. In recent years, the questions raised by the levels of stone replacement at York Minster, as well as at cathedrals in general, has prompted further scientific research into the environmental factors which affect magnesian limestone and the appropriate sourcing of stone for repair (Jefferson 2007; Pinchin et al 2008). Gradually, a strategy for the development of *in situ* repair methods to enable the retention of historic stonework has also been taking shape (Holton 2009). This highlights that this research rests within a much broader agenda that seeks to inform the conservation of York Minster and magnesian limestone buildings generally.

The problems associated with the extreme weathering of magnesian limestone have been affecting the East Front of the cathedral for some time. A thorough inspection of the fabric by Sir Bernard Feilden between 1965 and 1967 (YML/E7/1/1) had identified areas suffering from extensive weathering, erosion and 'sheltered decay', where recessed and faceted areas of the façade were breaking down as a result of sulphate attack. The historic relationship between air pollution in York and the decay of the Minster's stonework has been closely examined by Bowler and Brimblecombe (1990a; 1990b), who have concluded that a connection between the burning of fossil fuels and the deterioration of the cathedral has been observed since at least the seventeenth century. Cooke and Gibbs (1993, 26-27) have argued that the effects of this long-term pollution also constitute a so-called 'memory effect', where stone can continue to deteriorate irrespective of improvements in air quality if the products of pollution remain on the building. Bearing these factors in mind, and coupled with fact that the East Front is smothered in deeply modelled enrichment, means that Feilden's observations were not altogether surprising.

Of extra concern to Feilden, however, was the fact that the East Front appeared to be leaning outwards by some distance. This highlighted the potential for

structural problems, not least because the central and western towers were also found to be unstable. Concern quickly grew over the stability of the Minster in its entirety, and detailed monitoring of the fabric by the consultant engineers followed. This established the need for remedial action, leading to the unprecedented programme of underpinning the Minster with concrete and steel between 1968 and 1972 (Dowrick and Beckmann 1971; Feilden 1976). Importantly, such was the scale of the task of underpinning and stabilisation above ground that only minimal stone repair was actually undertaken in Feilden's time. Subsequent Quinquennial Inspections therefore recorded the same deleterious condition of the East Front, but it was not until 1996 that it was firmly recognised as a priority for repair (YML/E7/2/5, 61, 77). While attention was still focused on the completion of the West Front repairs and the commencement of the conservation of the chapter house vestibule at this time, a photogrammetric survey of the façade was undertaken in 1997 (Figure 7). This was able to illustrate the architectural complexity of the elevation and accurately record the nature and extent of its eastward lean.

In sum, then, the need to attend to the condition of the East Front had been on the Fabric Advisory Committee agenda for over thirty years, with the photogrammetric survey having been undertaken well in advance of 2005 when the preliminary specification for repair was finally drawn up. This specification anticipated the rebuilding of the two central buttress turrets and the dismantling and rebuilding of the Great East Window, along with the replacement of swathes of moulded and decorative stone (York Minster 2005, 9; Figure 8). This included the large seated figure at the apex of the Great East Window. Although appreciably undertaken as a costing exercise to establish a 'worse-case' scenario, the emerging proposals soon gathered momentum to a point where they were envisaged as the work that was actually going to be undertaken. An appeal for donations towards the repairs was launched in March 2005 entitled *The Development Campaign* (York Minster 2005). The literature associated with this campaign painted a typically grave picture of the façade and the remedial works required, including the rebuilding of the Great East Window because of its distorted form (York Minster 2005, 14). At this

stage, it was still assumed that the façade had remained largely unrepaired since its construction, save for the refurbishment of the window in 1824, the renewal of the central parapet in 1905 and the engineering work of the 1960s and 1970s (York Minster 2005, 14).

In 2005 an initial scoping exercise was undertaken by Dr Kate Giles the York Minster Archaeological Research Fellow and the author to ascertain the range of archival data relating to the East Front and the key moments in its repair history. Albeit superficial, this survey highlighted the extent of previous interventions in the nineteenth century as well as new phases of twentieth-century renewal and repair. This scoping exercise informed and was further enhanced by an historic geology survey of the façade prepared by John David the master mason in September 2005 (Figure 9). Both of these exercises highlighted the complexity of the façade and the need for further archival research and archaeological recording. However, in keeping with the conventional view of CoBRA in the conservation process, this research was not identified as a pre-requisite to the *formation* of the repair strategy. The perception of the East Front's significance was drawn from the extant architectural histories, rather than primary research, and the general view was that archaeological analysis would only enhance rather than transform understanding. This was observed by the York Minster carver Lee Godfrey (2005), whose MA dissertation sought to shed light on the significance of the masonry and sculptural programme of the Great East Window. Like the initial scoping exercises, this research-driven study also highlighted the potential complexity of the East Front as well as the vulnerability of its sculpture.

1.3.1 Buildings archaeology and the East Front: questions, aims and methods

Initially, this thesis was designed to respond to the unparalleled opportunity to access the East Front to explore the issues of complexity highlighted in the scoping exercises. From the outset two main elements informed the research agenda. The first was a suite of questions arising from the extant level of

understanding of the East Front; the second was the application of archival research and archaeological recording to answer these questions. As the research progressed, however, its iterative nature saw a closer development of its relationship with conservation and the practical processes of repair. This revealed that the increased level of understanding was inextricably linked to the way in which the building might be treated, both now and in the future.

The landmark studies of Jerry Sampson (1998; Ayers and Sampson 2000; Sampson et al 2000) at the cathedrals of Wells and Salisbury show that close scrutiny of a structure ahead of and during the process of repair can address academic research questions by shedding new light on the architectural development and meaning of a building that might normally be considered well understood. Significantly, however, because Sampson's studies were undertaken ahead of the *design* for repair there was also the opportunity for new findings to actively contribute to the approach to conservation. This potential for enhancing the understanding of a building as well as directly supporting its repair is also highly relevant to York Minster. Its medieval religious and architectural history has been scrutinised for centuries, along with its aesthetic qualities and place within the exchange networks of medieval art (e.g. Drake 1736; Britton 1819; Browne 1847; Aylmer and Cant 1977; Coldstream 1980; Brown 2003). Below ground it has also been comparatively thoroughly explored, and continues to receive considerable attention from scholars (Phillips 1985; Phillips and Heywood 1995a; 1995b; Norton and Harrison forthcoming). However, above ground there is still much to learn. While the stylistic and broad constructional evolution of the cathedral is reasonably well known, the minutiae of building and, especially, repair remains poorly acknowledged and for the most part unmapped. Only Phillips' (1999) study of the tracery of the Great West Window is an exception to this trend. Furthermore, the processes of magnesian-limestone weathering are only superficially defined at present and require careful documentation as well as scientific analysis. It is only usually with the erection of scaffolding that suitable opportunities arise to enhance and transform understanding.

York Minster and the history of repair

As is the case with cathedrals generally, the repair history of York Minster is a much understudied area in the literature, not least because this form of understanding has only become valued since the resurgence of church archaeology in the 1980s and the crystallisation of buildings archaeology in the 1990s. This gap in appreciation is an extension of the comparative shortfall in attention paid to the study of the post-medieval changes to the Greater Churches, with usually only the most conspicuous eighteenth and nineteenth century renovations by famous architects afforded an appropriate level of analysis by architectural historians (Cobb 1980; Arnold 2002, 9; Jokilehto 2005, 156-163; Barnwell 2008; Barnwell and Brandwood 2008). Yet the understanding of the nature, extent and context of previous repairs is crucial to developing the level of appraisal required for a building to be conserved appropriately. It is here that the stratigraphic approach of buildings archaeology is especially rewarding, as it enables a deeper understanding of the changes that have taken place upon a structure over time, leading to the production of an interpretive narrative and/or drawings of the phases of change that have taken place – in short, it sheds light on the question of authenticity. Being aware of these past changes is vital to the conservation of masonry buildings, as relative significance will be placed upon the different units of the building and will affect value-related judgements. This is especially important in borderline cases for renewal, where the knowledge of whether or not a stone is an original component of the fabric will often determine whether or not it is replaced (Sampson 2006, 59).

The primary fabric of a building is traditionally regarded as more significant than what follows, and so at the very least it must be carefully defined by unravelling the more 'expendable' restoration work from the original material through stratigraphic analysis. However, while the aim of this research is to explicitly define the extent of primary material within the East Front, it will also show that the intimate understanding of past repairs can further enrich the history of the building and can potentially enhance the perceived significance of

the physical fabric in both absolute and relative terms. Moreover, in the context of practical conservation it can shed important light on the problems encountered in the past, the action that was taken as a response and the consequences of that action. The close dating of the different elements of the fabric can also help to estimate rates of attrition, and whether or not problems are new or recurrent, dormant or active. When it comes to replacing stone, it will also be seen how a detailed knowledge of the repair fabric can influence the choice of forms to reinstate when faced with the challenge of maintaining the Minster's complex design.

This research strategy is supported by the views of Chitty (1992) and Heaton (2009) that buildings archaeology is in fact a form of building pathology, which is now seen as an essential pathway of investigation in the successful conservation of stone buildings. In conservation, Smith and Přikryl (2007) have identified the analogous relationship between diagnosing and treating disease in a person and the determination and response to mechanisms of stone deterioration. Both approaches seek to arrest the 'illness' by assembling a picture of the subject's history and symptoms in order to define the underlying cause and appropriate treatment. Understanding the 'patient's' background is seen a crucial element of the process, as it helps to build a detailed awareness of the potential 'memory effect', or stress history of the subject (Smith and Přikryl 2007, 3). In medicine, this would entail an investigation into the patient's clinical history, their lifestyle and the environments in which they had lived in order to confirm the nature and causes of the illness. For buildings, an investigation into the source of the stone and its subsequent exposure to deleterious action (both environmental and human) provides an equally necessary platform from which to prescribe remedial treatment. However, the perception of the memory effect upon the stone of York Minster has remained relatively narrow, going no further than recognising the hangover of atmospheric soiling and sulphation caused by the historic air pollution (Cooke and Gibbs 1993, 26-27). This highlights the requirement for further investigative study to expand the understanding of the memory effect, absorbing the human dimension in the case history of the stonework of the East

Front. While this may considered irrelevant to stonework that needs to be replaced, its importance when attempting to repair material *in situ* is clear. The history of any previous intervention from cleaning to surface treatment must ideally be identified first so that conservation methods are applied with both underpinning knowledge and confidence, and potentially harmful techniques are avoided.

Some of the potential virtues of unravelling the repair history of part of the Minster to inform complex conservation decisions appear in microcosm in Phillips' (1999) analysis of the Minster's Great West Window, recorded in 1986 ahead of its complete renewal. In line with contemporary practice, archaeology was envisaged as a response to repair proposals. Importantly, the lack of a detailed understanding of the history of the window had led to conflicts over the reparation of the window. These were driven in part by the assumption that the window was only a nineteenth century replica of the medieval original (Phillips 1999, 29). However, close analysis of the construction and repair sequence of the window revealed that the tracery was in fact the work of the 1330s and this knowledge became pivotal in the final approach to repair (Phillips 1999, 24). Consequently, and importantly, the decision was then taken to replace the window in order to preserve the original tracery. Critically, however, Phillips' work also demonstrated that when such analysis was integrated into the initial decision-making process it can inform rather than obstruct design.

Once the significance of the complexity of the East Front and Great East Window stonework had been revealed by the initial survey exercises and study by Godfrey (2005), it supported the research design of this thesis within the broader research context of informing conservation outlined above. This design focused on not only archaeological survey on the scaffold but also a detailed analysis of all archival material relating to the construction and repair of the East Front from the medieval period to the present day. While aiming to expose new information about the construction and repair history of the façade, this study also sought to unite with existing scholarship to create a corpus of

material that could be actively used to inform the conservation process. In turn, it was also able to address some of the long standing debates regarding the Minster's medieval design and construction, and to record important elements of the fabric which had previously gone undocumented owing to their inaccessible position on the building. Furthermore, it also facilitated an examination of the archaeology of one of the most infamous moments in the cathedral's history: the destruction of the choir by fire in 1829 (Chadwick 1977, 274-278). This event is assumed anecdotally to have impacted upon the condition of the Great East Window, as well as being a main cause of stone replacement on the East Front in the 1830s. The need to begin an assessment the contribution of this catastrophe to the fabric above ground is therefore long overdue.

In the knowledge that magnesian limestone is especially prone to decay, the value of documenting the minutiae of construction and repair became increasingly self-evident. In time, and with changes in personnel at management level, this became central to the approach to repair, especially for important areas such as the sculptural surround of the Great East Window. However, from the outset the integration of the historical and archaeological research process with the East Front repair programme was not easy. This has much to do with the established role of archaeology, and more recently buildings archaeology, at York Minster. Normally, a programme of recording would be devised in *response* to the design proposals of the architect, or if an unanticipated feature was uncovered during the process of renewal or excavation.

This mechanism is to a large extent built upon the particular circumstances in which archaeological practice has developed at the Minster since the 1960s, alongside the broader perceptions of archaeology already considered above. The 1968-71 rescue excavations at York Minster that took place ahead of the underpinning were a pioneering exercise in church archaeology (Phillips 1985; Phillips and Heywood 1995a; 1995b). Their legacy can still be sensed in the implementation of research, analysis and recording today and, as a result, the

term archaeology is still frequently synonymous at the Minster with a below-ground, reactive process. Significantly, when these excavations were undertaken the roles of each practitioner – architect, engineer and archaeologist – were also rigidly defined and adhered to. This perception was still being sustained at the beginning of the East Front project, where it was assumed that the archaeological dimension would not be concerning itself with the questions of repair and renewal that lay purely with the architect, master mason and, where necessary, structural engineer.

A further (and perhaps greater) relevant factor is the distinct manner in which archaeological responsibilities at York have come to be divided between the Cathedral Archaeologist and the Department of Archaeology at the University of York. In the wake of the synthesis and publication of Phillips' work on the Roman Legionary Fortress beneath the Minster (Phillips and Heywood 1995a; 1995b), the York Minster Archaeological Research Fellowship was founded in 1999 (Kate Giles pers. comm.). The aim of this fellowship was to nurture a formal relationship between the Minster and the department which would seek to facilitate research projects on the history and fabric of the building. Significantly, by the early 2000s the fellowship also absorbed the responsibility of recording the above-ground archaeology of the building ahead of repairs. However, while the Fellowship should be seen as a positive contributor to the understanding of the Minster's past, its detachment from the Fabric Advisory Committee (the core management system for care of the building) means that, at present, it arrives too late to materially affect the decisions made by this council instead playing a more strategic role in the development process.

In turn, this highlights the fact that the necessity for and timing of such recording are decisions that continue to lie with the Cathedral Archaeologist. As is the case at so many cathedrals, the degree and nature of archaeological input to the management of the building invariably depends on the specific expertise and research interests of the Cathedral Archaeologists themselves. These interests may often centre upon the below-ground archaeology of the site, especially as the careful treatment of buried remains still lies at the heart of the

Care of Cathedrals Measure. In the case of the East Front project this has vital implications. Importantly, when preliminary archival research was commissioned in 2005 the design process was already well underway and decisions about the extent of repair already taken.

As a response, one of the aims of this thesis was to therefore demonstrate the value of historical and archaeological research as a proactive undertaking that could contribute to the design for repair. However, in light of the role of buildings archaeology being overlooked as an early-stage contributor this was made problematic by the fact that the intended research timetable was at odds with the gathering momentum of the East Front project. Before close archaeological enhancement of the photogrammetry could take place the easternmost bay of the north clerestory was dismantled, while renewals were also undertaken upon the lower stages of the south buttress of the main façade before the recording remit had been satisfied. Similarly, the interior east-window scaffold was erected almost without warning. This meant the rapid recording of the lowest inner stages of the interior just ahead of the scaffolding, and the frustration of having to temporarily postpone the archival study.

Gradually the progress of the research was able to align itself with pace and needs of the repair programme so that information could begin to travel between the two. However, this also served to expose some tensions between archaeology and conservation on the one hand and established craft practice on the other. These tensions were directly in tune with the generic response to the concept of conservation as a restrictive measure highlighted earlier in this chapter. The initial dialogue revealed that there was a distinct concern amongst the craftsmen that archaeological discovery and conservation would threaten the potential for renewal by constantly challenging for the retention of existing fabric on the building. This was exacerbated perhaps by the fact that the undertaking of most of the *in situ* conservation work was restricted to one craftsman, and not seen as part of the everyday practice of all masons. In response, one of the developing aims of this project was to address these tensions by expanding the initial aims of this thesis. This not only demanded

extending analysis to the history and archaeology of craft practice at the Minster but also an exploration of whether or not buildings archaeology could actually lead to the formation of practical solutions, and a balance between protecting the significance of the building and the integrity of its design. In part fulfilment of these aims, considerable time was spent developing the dialogue within the Stoneyard, which involved the explanation of findings, the discussion of ideas on the construction and repair sequence of the East Front and engaging the craftsmen in the conservation debate. Eventually, the strengthening of this working relationship led to the author being invited to undertake an internship with the Stoneyard in the summer of 2008. This facilitated the delivery of a documentation strategy for the recording of *in situ* repairs in exchange for training in lime-based conservation techniques for decorative stone. The impact of this dimension of the thesis is the subject of Chapter 5.

1.4 Conclusion

This opening chapter has presented the context in which this thesis is positioned and the themes of debate with which it will engage. The scaffolding of the East Front presents an opportunity to closely analyse a part of York Minster and address questions relating to its history, archaeology and significance as well as its conservation. This responds to the questions and challenges posed by the position of buildings archaeology and conservation at York Minster and beyond, alongside the chance to investigate and document a substantial part of the cathedral in new ways. Chapter 2 outlines the methods of investigation and recording employed, as well as the structure of this thesis which will convey the information as a narrative of the East Front's pathology in Chapters 3 and 4. These core chapters will show that the combination of meticulous documentary research with close-range archaeological analysis not only supports, challenges or refines the contributions of previous scholars, but also generates whole new episodes in the evolving history of the Minster. As the concluding section of this thesis, Chapter 5 will demonstrate the proactive impact that detailed research, recording and analysis can have on the

conservation process, instead of being simply an academic luxury that merely reacts to the predetermined aims of repair. It will also challenge current recording and conservation practice, and will propose new ways in which the two can be harmonised in order to manage change in the best interests of the building.

CHAPTER 2

THESIS STRUCTURE AND METHODOLOGY

2.1 Introduction

Chapter 2 summarises the structure of this study and the methods employed. The thesis moves from the archival and archaeological analysis to discuss the impact of research on the conservation of the East Front. The methodological approaches employed for the purposes of this study are also outlined in this chapter. These methods not only address the research aims of this thesis, but also intend to meet, and extend beyond, the Level 4 criteria set out by English Heritage (2006, 14, 16) for buildings of special importance undergoing substantial repair. This normally includes detailed drawings, photography and a written account prior to intervention, but in the case of this thesis attention is also closely paid to recording *during* the current process of repair.

2.2 Thesis Structure

This thesis is divided into two separate volumes. Volume 1 comprises the text and bibliography, which includes a summary of the documentary and pictorial sources used. Volume 2 comprises the figures, drawings and appendices that accompany the text. Appendix 1 is a complete photographic record of the exterior carved voussoirs of the Great East Window. Appendix 2 is a catalogue of condition maps of these voussoirs. Appendix 3 is a selection of intervention records relating to the recent *in situ* repair of carved stones on the south buttress of the East Front. Appendix 4 is the research design for the conservation of the masonry and sculpture of the Great East Window.

Within Volume 1, Chapter 1 has established the research aims of this thesis, namely to develop a detailed understanding of the repair history and archaeology of the Minster's East Front in order to address the questions of its

appropriate conservation. This directly informs the structure and content of Chapters 3 and 4 respectively. Importantly, both of these chapters also acknowledge extant literature and understanding within these fields.

Chapter 3 presents a synthesis of the archival evidence, beginning with the construction of the eastern arm of the Minster in the 1360s and finishing with the engineering operations of the 1960s. Ideally, the repairs to the parapets in the 1980s and 1990s would also have been included as items for consideration in this chapter. However, access restrictions to this area of documentation have unfortunately prevented a complete analysis to the most recent period of interventions. Nevertheless, Chapter 3 creates a detailed picture of the East Front through the lens of documentary sources, from materials to craft practice. This provides the corpus of contextual information which intimately complements the archaeological analysis of Chapter 4.

Chapter 4 outlines the archaeology of the construction and repair of the East Front as derived from close-range analysis from the external and internal scaffolds. It is divided into two main sections. The first is an interpretive narrative of the façade's development from its foundations to spirelet level, with close attention paid to the interplay between primary and repair fabric, and the problems that the masons faced over time. Although the place of the East Front within the fourteenth-century reconstruction of the eastern arm of the cathedral is carefully considered here, close analysis of the spaces beyond the façade unfortunately lie beyond the scope of this thesis.

The second section of Chapter 4 deals with the masonry of Great East Window itself. It explores previous repairs to the window and the surrounding sculptural ensemble, before examining the position of these elements within the building chronology of the Minster's eastern arm. This is followed by a detailed discussion of the form, condition and arrangement of the East Front sculptures and an interpretation of their date, meaning and significance.

Chapter 5 provides a conclusion to this thesis. It considers the extent to which the research aims laid down in Chapter 1 have been met and the impact that the

enhanced understanding of the East Front has played in the active conservation of the façade. The tensions discussed in Chapter 1 are also revisited. This leads to a reconsideration of how buildings archaeology should be integrated within a fresh conservation strategy that responds to the building-specific challenges posed by the Minster. The thesis ends by identifying the questions raised by this research. These questions relate directly to the future conservation of York Minster, as well as the broader practice of informing and undertaking conservation of magnesian limestone buildings.

2.3 Methodology

2.3.1 Archival Research

This thesis draws on a wealth of archival sources to shed light on the construction and repair history of the East Front. The collections at the York Minster Library and Archives (YML) have provided most of the evidence used in this research. Additional material has been gained from the Canterbury Cathedral Archive (CCA), the National Monuments Record (NMR) Swindon, the archive of the Society for the Protection of Ancient Buildings (SPAB) and numerous online image resources.

The archival evidence comprises three main forms of document: written sources, prints and drawings, and photographs. These are summarised at the start of the bibliography to the rear of Volume 1. Central to the written sources are the Fabric Rolls of York Minster. These building and repair accounts survive from the mid-fourteenth century onwards, gradually evolving into the modern accounts of today. This study makes use of the most recent transcription of the accounts undertaken by Phillip Stell (forthcoming), who builds upon the nineteenth-century work of James Raine (1859). Although the detail of information within these accounts varies, they remain a valuable link to the history of the East Front, shedding light on the date and nature of work, the composition of the workforce and the materials employed. Supplementary written sources to the accounts include official papers relating to the fourteenth-century reconstruction of the eastern arm, contemporary accounts

to building and repair phases, and, later on, reports and surveys by architects and engineers. This research also treats antiquarian narratives as both eyewitness accounts of the fabric as well as part of the Minster's architectural history. This enables changing perceptions of the fabric to be assessed, providing a long-term biographical view of its state of repair and change alongside previous interpretations of its medieval development. However, while the role of the medieval Archbishops and bishops in the development of the East Front can be outlined with some authority, the same cannot be said for the influence of individual Deans on the post-medieval repair programmes. This is because a sequence of valuable statements on works to the fabric that were created since at least the eighteenth century (known as the Deans' Annual Reports) have long been missing from the YML (Peter Young pers. comm.). Therefore, only glimpses of the involvement of Deans has been observed and adumbrated in this thesis via secondary sources.

Prints and drawings are also a valuable source of information. Although such sources were not always created as an accurate record of the fabric, they often provide useful detail on the overall appearance of the building in the pre-photographic era. For the purposes of the craftsman, this value is seen as particularly strong. This is because prints and drawings are frequently used to inform new carvings. However, this thesis also looks to examine these sources more critically as interpretative statements of the fabric, with caution paid to the aims and constraints of the artist and the application of the information derived from them.

An extension to the analysis of prints and drawings is the YML architectural drawings collection. This includes scaled and full-size drawings of elements and details selected for repair or renewal. Although their purpose is not always explicitly indicated, these drawings are usually dated and provide more reliable insights into areas being repaired because measurements were being taken directly from the fabric itself. A small number of unpublished excavation drawings relating to the 1960s underpinning of the East Front are also

incorporated into discussions on the below-ground archaeology of the façade in Chapter 4.

The final source of archival information used for the purposes of this research are historic photographs. Photographs provide an excellent record of the past, capturing the form and condition of the East Front at a given time in an instant. They provide close insights into the historic soiling patterns of the building, helping to improve the picture of the 'memory effect', as well as the extent of decay and the alteration or loss of surfaces. The earliest specific photographs of the East Front are from the 1850s. Thereafter there is a steady supply of images illustrating the elevation as a piece, as well as elements and details at close range captured before, during or after repair. Photographs also form a principal element of the 1960s excavation record and strongly aid the analysis of the foundations in Chapter 4.

2.3.2 Archaeological Recording and Analysis

The scaffolding of the East Front provides close-range access from which the archaeology of the façade can be recorded and studied stone-by-stone. Given the scale and complexity of the elevation, two methodologies form the basis of recording: the enhancement of the 1997 photogrammetry and photography. The enhancement of the photogrammetry entails the annotation of printouts on-site, as well as the addition of details or areas using hand survey that could not be captured effectively at the photogrammetric stage. These details include masonry joints, moulding lines, carved detail and interior wall passages. The annotated drawings are worked up in AutoCAD™ to show the sequence of construction and the phases of subsequent repair by date and stone type. Evidence of previous surface treatments and reinforcements are also recorded, as well masons' tooling concealed within bed joints and observations on the finer aspects of the construction and repair sequence. These include notes on the rebuilding of an area in the past using extant fabric and information recovered during the current process of repair. It is important to note here that the lowest levels of the scaffold have remained unboarded throughout this

programme of research. As a result, only superficial recording has been achieved at these levels.

Image-based survey using photography is also central to the recording methodology employed on the East Front, not only in order to gain images for the purpose of this thesis but also to support the assembly of the project archive. Prior to the commencement of major works, a detailed colour photographic survey of the façade was undertaken using an Olympus E510 10 mega-pixel digital SLR. To achieve this every element of the façade is photographed, beginning at the summit and working down through the scaffold lifts. Characterisation shots of each area and element, e.g. a level of buttress niches, are also taken from every angle. This is followed by detailed photographing of individual sections, such as single niches, and then the details of those sections. Sample images of stone types and mortars were captured at approximately x50 and x200 magnification using a Veho™ USB microscope. Photography and note-taking also form the watching-brief aspect of the recording, with regular characterisation and detail shots taken during renewal and *in situ* repair. Inevitably, a vast number of images have accumulated in the course of this research with only a fraction selected for inclusion in Volume 2.

Chapter 4 will also show that a further level of recording and analysis is reserved for two further areas of the façade: those deemed to be of special significance that are particularly prone to loss, and those that have been repaired *in situ* using lime-based methods. For those areas seen to be especially vulnerable, detailed condition surveys are undertaken with reference to the *ICOMOS-ISCS Illustrated Glossary on Stone Deterioration Patterns* (2008). The aim of this exercise is to create a point-in-time record of such areas so that judgements on alteration over time can be more reliably informed and mitigation strategies appropriately administered. The condition survey is based upon the annotation of close-range photographs to convey point-in-time decay patterns and observations. These images are then marked up using Adobe™ Illustrator to create a distributable digital record. Similar methods have been employed to record the *in situ* repair of stonework. Again, this aims to generate

an archive of current treatments so that future practitioners are more suitably informed into the nature and success of the approaches being used in the present to extend the life of stones.

CHAPTER 3

CONSTRUCTION AND REPAIR ~ *The Archival Evidence*

3.1 Introduction

This chapter elucidates the construction and repair history of the East Front. It examines written and pictorial evidence to provide a detailed context for the building and repair campaigns that took place between the mid-fourteenth century and the end of the twentieth century. As has been argued in Chapter 1, access to historical information on the building and maintenance of the façade is fundamental to a coherent understanding of its archaeology and the history of the problems that have been encountered over time. This thesis will show that the two main forms of evidence, the documents and the fabric itself, are able to mutually reinforce or question one another. While the archaeological analysis described in Chapter 4 is able to define patterns of building or repair upon the East Front through geological and stratigraphic recording, the documentary evidence is able to shed light on when and why such changes may have taken place.

York Minster has in its possession a vast archive of information related to the building that provides a detailed insight into the construction and repair history of the cathedral. Some of the most useful sources of information are the Fabric Rolls (Browne 1847; 1863; Raine 1859; Stell forthcoming). As their title implies, these building accounts survive firstly as vellum rolls from the mid fourteenth century, which were superseded by loose-leaf paper in the eighteenth century and, by the late nineteenth century, by bound volumes. These documents are supported by numerous additional forms of record, including the Chapter Acts, wills, architects' reports, contemporary accounts by chroniclers and antiquarians, working architectural drawings, prints, etchings and photographs. By developing a detailed narrative for both the construction *and* repair history

of the East Front, this thesis is able to draw these sources together systematically for the first time. This provides a platform from which the archaeology of the façade and the historical integrity of the original fabric can be interrogated. In regard to past intervention, this narrative is able to highlight areas where stone replacement has taken place more than once since construction, or where stone decay and structural trauma has been observed over centuries. In the case of the former, the archival evidence is especially valuable as subsequent replacement may have wiped away the physical indication of earlier phases of repair. Regarding the latter, Chapter 5 will show that the ability to recognise decay, cracking or distortion as old, recurrent or continual phenomena is invaluable in informing the approach to practical repair in the present. In some cases, the problem may be identified as historic and therefore less likely to pose any significant threat to the stability of the fabric. In turn, the necessity to intervene in certain areas can be minimised. As Chapters 4 and 5 will show, this is especially relevant when considering the eastward inclination of the façade. Conversely, where certain phenomena are not represented in the historical record, or appear undesirably recurrent, then the need for action in the present can, to a certain degree, be informed, facilitated and reconciled. However, throughout it will be apparent that there are problems with the documentary sources and that the process of analysis ultimately relies on a reflexive use of all forms of evidence to explore the archaeology of the East Front.

3.2 The Medieval Construction from 1361

3.2.1 Overview

In a recent paper on Archbishop Richard Scrope and York Minster, Christopher Norton (2007, 138-139) highlighted the problem of the 'terminological inexactitude' used by previous writers in describing the history of the 'choir', or eastern portion of the building. This inexactitude arises from the differences between the architectural and liturgical divisions of the east end. While the term 'choir' is used in an architectural context to define the space between the

central tower and the choir screen, or even the entire eastern arm, liturgically it refers only to the first three bays east of the tower occupied by the choir stalls. Similarly, the four easternmost bays of the eastern arm are commonly referred to as the 'Lady Chapel', yet liturgically the Lady Chapel only occupied the easternmost bay of the east end of the Minster. For the purposes of consistency and clarity, the definitions offered by Norton (2007, 138-139) and summarised in Figure 10 will also be adopted here for the discussion of the medieval building chronology.

The history of the fourteenth-century rebuilding of the eastern arm, and therefore the East Front, has received considerable attention from previous scholars. The most recent synthesis is that of Sarah Brown (2003, 137-169). This builds upon the seminal studies of John Browne (1847, 147-291; 1863, 1-8, 30-47), the Rev. Robert Willis (1848), Eric Gee (1977; 1981) and John Harvey (1977). These are unanimous in assigning the start of the main building campaign of the four easternmost bays of the eastern arm to 1361. All attribute this to the patronage of Archbishop John de Thoresby (1352-†1373). Thoresby was one of the most influential figures in the history of the Archbishops of York, as both a respected theologian and munificent benefactor. He was well-connected with King Edward III, and it has been noted that Thoresby continually viewed the church as 'both an English and state institution' (Hughes 1988, 133). Significantly, the Archbishop was singularly responsible for a number of generous gifts to the fabric during this undertaking, and so it is conceivable that his benefaction was honoured with a certain degree of involvement in the design and subject matter of the new eastern arm.

3.2.2 The Fabric Rolls: an introduction to their application

So far, the main sources that have been used by previous scholars to reconstruct the fourteenth-century rebuilding of the eastern arm have been the Fabric Rolls, combined with the medieval chronicle of Thomas Stubbs, the Chapter Acts, and, on occasion, wills. These sources are discussed in greater depth below. Before reviewing the documentary evidence however, it is necessary to consider the

Fabric Rolls a little more critically as a central source of data for the later medieval rebuilding of the eastern arm of York Minster, and for the study of medieval craft practice and materials in general.

The first extensive study of the Fabric Rolls was undertaken by John Browne (1847; 1863). They were then re-examined by the Rev Willis (1848) and selectively published by James Raine (1859). In recent years, the rolls have been re-transcribed by the late Philip Stell (forthcoming), and it is the unpublished version of this work which is used here[1]. The use of the rolls as a source for the medieval period is problematic because they survive in only a fragmentary state from the middle of the fourteenth century, with the first shedding light on purchases of stone and dated by Stell (forthcoming, 1) to between 1350 and 1355 (YML/E3/1). Furthermore, and of direct significance to this thesis, is the fact no rolls survive from the 1360s, which has been argued to be the main period of building work on Thoresby's east end. It is not until 1371 that the rolls resume. Even then there is little precise indication of exactly how much of the structure of the re-modelled eastern arm had been completed.

The rolls were also created to justify expenditure on the fabric, and so their use as a historical narrative carries a further number of caveats (Willis 1848, 35-36). While the rolls provide an important insight into the organisation of the medieval builders, the materials used, and the means by which construction campaigns were funded, it is rare for locations of work or the rate of progress to be recorded explicitly. Indeed, both patron and cleric would have been made aware of where funds were being deployed, and any visitor to the cathedral between the thirteenth and fifteenth centuries would have seen the Minster as a vast building site, with the extent of progress fairly obvious. Moreover, the Minster workforce were generally waged, and so, again, the listing of specific features and locations of work was not required in the way that they may have been had payment been readily made by the individual piece. Within the Fabric

[1] With the kind permission of Dr Richard Hall and York Archaeological Trust

Rolls only very specific objects, such as altar furnishings or bells are itemised, perhaps because such features were funded by personal donations or bequests.

In spite of this, the Fabric Rolls contain important information about *how* the Minster was built and what was used to build it. Although they offer little direct information about the construction of the East Front, they reveal the broader picture of contemporary materials and working practices. This is relevant to understanding how Thoresby's east end was constructed, and how the materials used contributed to the behaviour of the façade during and after construction. Furthermore, this wider perspective on practice raises new questions that relate to existing attitudes and methods of repair at the Minster and beyond. In an institution which sees itself as working in the footsteps of its medieval predecessors, to what extent is it faithful to the history of the craft? And can knowledge of the sourcing of materials, such as stone and lime, inform the same in the present? Such questions will be considered in more detail in Chapter 5.

3.2.3 The documentary evidence: materials and craft practice

Before considering the evidence for the chronology of Thoresby's east end, it is therefore also necessary to outline the materials, methods and personnel that were at hand to build it. This section is a summary of these key areas, paying particular attention to stone and the composition, organisation and working methods of the men that were employed.

Stone

The sources of stone used to build the Minster were exploited for many other great medieval building projects, both regionally and nationally, and this has led to a considerable amount of scholarly interest in the subject. Moreover, the need to understand the different stone types of these buildings is vital to the understanding of their sequence of construction and maintenance, and fundamental in the prospection of suitable stone for the repairs of today

(Jefferson 2007). To date, the most comprehensive collation of the documentary evidence for stone used in the medieval Minster is by Eric Gee (1981), who provides a useful overview of the quarry sites and the contexts for their exploitation. More recently, the understanding of historic quarrying activity in the region has also been greatly advanced by geological field survey (Jefferson 2007; Lott and Cooper 2008, 81; Figure 11). This has demonstrated that magnesian-limestone quarrying for building purposes has significantly diminished since the late nineteenth century.

For the most part, the eleventh-century cathedral of Archbishop Thomas of Bayeux was built with re-cycled stone from the buried structures of the Roman *principia* on which it came to stand (Gee 1981, 247; Phillips 1985, 182). This re-used stone comprised a mix of stone types, particularly magnesian limestone, Lincolnshire limestone and carboniferous sandstone (or 'millstone grit'). However, while documentary evidence for fresh quarrying of magnesian limestone by Thomas's builders is lacking, an examination of the surviving high-level works of the eleventh-century cathedral within the nave roof-space has raised the possibility that it had been necessary to obtain new stone for the completion of the project (Phillips 1985, 184).

The re-modelling of the east and west ends of the Minster by Archbishop Roger of Pont L'Eveque in the middle of the twelfth century appears to have necessitated the procurement of fresh magnesian limestone, and by 1184 there is a specific reference to stone being worked at a quarry at Hazelwood, south-east of Tadcaster, in a grant by William le Vavasour to Salley Abbey (Gee 1981, 247). The families of Vavasour and Percy are well known for their grants of materials for the building and repair of the Minster, with their generosity and co-operation duly commemorated with effigies and heraldry around the building. Unlike the Vavasours, however, the Percys appear to have been responsible only for the donation of timber to the cathedral, as there are no references to stone amongst the Percy Charters (Gee 1981, 247).

By c.1225 the source at Hazelwood was known as Thevesdale, and although writers have been keen to ascribe this title to a single site, it seems more likely

that it referred to the region between Hazelwood and Tadcaster in which a number of quarries were worked, and then abandoned, over time. The site of Jackdaw Crag has often been ascribed as this quarry, although there is apparently no surviving evidence of any medieval quarry-face there (Brooke 1976, 19). Writing in the early eighteenth century, however, the antiquarian Thomas Gent records an oral tradition of the location of one of the Vavasour quarries, which must have been visible, if not still in use:

'And here, to do Justice to the antient Family of the Vavasours, or Valvasores, we cannot well pass over what Mr Camden says, "That near Hesselwood within 12 miles of York lyeth a most famous Quarry of Stone, call'd St. Peter's Post, for that with the stones hewed out of it by the liberal grant of the Vavasours, that stately and sumptuous church of St. Peter's at York"'

(Gent 1730, 33)

Gent also comments on the properties of the stone, offering the earliest insights into its suitability for carving and apparent ability to strengthen after seasoning:

'And some tell us, that the Property of that Stone is such, as to be very soft, and consequently more easy for the Carvers, when newly taken away, which after hardens the more, the longer it is expos'd to the air: A stone as if Nature itself had contriv'd to further on the Workmanship.'

(Gent 1730, 34)

The documentary evidence suggests that until 1385 the quarry, or quarries, between Tadcaster and Hazelwood were the only sources of stone for the Minster. In that year, however, a lease for eighty years at the quarry at Huddleston, near Sherburn-in-Elmet, was established with the Langton family. However, this lease does not survive, and is only known by the fact that its termination was recorded in 1465; thereafter, the lease was renewed for eighteen years, but from then on the owners were paid on an annual basis for the stone that was required (Gee 1981, 252-253). Exactly why Huddleston

stone began to be chosen in preference to Thevesdale is unclear from the documentary record, although its durability and workability may have been considered superior by the medieval masons. Should this be the case, then these qualities would not have gone unnoticed by the builders of Thoresby's east end at York as this involved the re-use of twelfth century Huddleston stone from the derelict Archbishop's Palace at Sherburn-in-Elmet (Brooke 1976, 28). By 1423 the delivery of Thevesdale stone to York had ended, and by 1449 Huddleston was being selected over the Vavasour quarries for the works at King's College Chapel, Cambridge, and Eton Chapel (Brooke 1976, 26; Gee 1981, 250). Huddleston stone continues to be recorded in the Fabric Rolls in the first half of the sixteenth century, after which there is a lack of evidence for the sourcing of Minster stone generally. It is likely, however, that the working of the Huddleston quarries was intermittent, as they had to be reopened for use in the restoration of the eastern arm in the 1830s.

In the midst of the references to the Tadcaster and Huddleston quarries lies evidence for the exploitation of several other sources for the Minster, namely Stapleton near Pontefract, Doncaster, Bramham and Hampole. At Stapleton, the quarry was being worked c.1300 and in the second half of the fourteenth century it saw extensive use at Windsor Castle (Gee 1981, 254). In 1399 the carriage of Stapleton stone appears in the Minster Fabric Rolls. The master mason, Hugh de Hedon, visited the quarry personally with Lawrence de Broughton, and in July 1400 Henry VI allowed the Minster to carry stone from Stapleton toll-free (Gee 1981, 254). The last surviving reference to the stone in the Fabric Rolls is in 1403, which records the carriage of stone, the repair of tools, a quarryman's fees and a site visit by de Broughton.

The remaining sites have been grouped by Gee as miscellaneous quarries. The Minster purchased stone from Doncaster c.1400, and again in 1415-16. These references may refer to the quarry at Hampole, or, alternatively, may be evidence of early extraction at the sites now known as Cadeby and Warmsworth. By the early sixteenth century Hampole appears as a quarry in its own right, and purchases were still being made by the Minster in the 1520s and

1530s (Gee 1981, 255). Stone was also brought from Bramham (later known as Bramham Moor) in the fifteenth century, and although it was not valued particularly highly it was apparently used in the production of 'special forms' (Gee 1981, 255). That it was used for carved work may be indicative of the properties of Bramham stone at the time, in that it was relatively soft and suitable for carving but less desirable for structural or exposed exterior work. As Jefferson (2007, 1) argues, medieval masons were well aware of the value and durability of different stones, both within the quarry and between quarries, and they were able to selectively work the most appropriate material for a specific role or location in the building. Thus, while softer beds may have once been solely quarried for carved work, harder faces would have been exploited for weatherings and ashlar. In time, these criteria for selection may have become confused or lost as quarrying for building in magnesian limestone declined, so that by the nineteenth century (from when most of the problems of stone selection emanate) the wrong stones were being used for the wrong purpose.

Craft practice

The origins of studies into the craft of the stonemason lie in economic history (Knoop and Jones 1933), but the subject has since attracted the interest of archaeologists and architectural historians in their desire to understand the social context in which medieval buildings were created, and the process and means of construction itself. Furthermore, this interest should not be seen as exclusive to academic study either, since a knowledge of past practices is of great importance to the craftsmen of today who seek to sustain traditional techniques of repair. Indeed, being able to argue 'how it would have been done' is often a valuable means of justifying the way in which a building should be repaired in the present. Therefore, having a more complete picture of past working practices might be able to further develop or refine such justifications, whilst also shedding light on the way in which the Minster was constructed to inform the interpretation of its archaeology.

The fortunate survival of the Fabric Rolls means that a wealth of important information exists that can shed light on the working practices of the medieval masons. Although much has already been achieved by previous scholars such as Salzman (1997) and Harvey (1971; 1972), their studies aimed to provide only a general understanding of the craft. As a result, the Fabric Rolls continue to merit further study when set in the context of conservation-based research. While references to sources of stone are accessible, and therefore oft cited, less has been said about the *minutiae* of building, such as the original sources of lime and sand for mortar at the Minster, or the significance of the presence or activities of the quarrymen. While these items may be superfluous to the historian, to the buildings archaeologist and conservator a thorough understanding of the nature of the materials used in the building process is essential. In the case of the archaeologist, the construction history of the fabric and the significance of its parts can be realised, while the conservator is better placed to re-create a traditional and authentic repair mortar if he or she is aware of where the raw materials came from and how they may have been prepared.

The problems associated with the paucity of Fabric Roll evidence for the period in which Thoresby's east end was built has already been noted above. However, as the survival of documents gains momentum into the 1400s, a comparatively good understanding can be gained regarding the operations of the Minster's builders. Studies such as those by Salzman (1997), Harvey (1972) and Coldstream (1991, 15-19) have long since emphasised the hierarchical organisation of master mason down to labourer, and the Fabric Rolls show that at the Minster this is consistent with this pattern. The workforce were waged, recorded under the headings of *stipendio cementariorum* (payments to the masons), or *stipendio operariorum* (payments to the general workers). Generally speaking the men were paid by the week, with some employed for the entire year and others for only a few weeks and days. In these instances the masons were probably being hired as piece-workers, but being paid for a particular section of work rather than by individual blocks.

Activity at the quarry was also given a separate heading in the rolls (*custus quarere*), shedding light on the costs of extraction by the quarrymen and the subsequent carriage to York. The stone was probably worked as far as was possible at the quarry, not only to avoid the cost of carrying excess material, but also because the stone was probably still in its most workable state, prior to seasoning. Although the medieval masons at the Minster may have left uncut blocks to season during the initial selection process, for example when they were investigating the quality of new beds, it is likely that they would have taken advantage of the natural behaviour of the stone for carved work. Unseasoned, the stone remained at its most workable, before hardening and gaining its durability on the building itself. Moreover, the practicality of stockpiling large amounts of stone for a project on the scale of the eastern arm may have made such practice less likely in this case.

The masons were also guided by the seasons of the year and by the hours of daylight, and there is primary evidence for the way in which the workforce structured their working year. Two examples of the *Ordinances of the Masons* survive from York, which were published in the nineteenth century by Raine (1859, 171-173, 181-182). The first example was drawn up c.1352, and the second on 31st October 1370 when Thoresby's east end was still under construction. This second example shows that the masons worked all the year round, but between Michaelmas (29th September) and the first Sunday of Lent the working day was restricted to the hours of daylight, and building work also probably ceased, with attention then focused on the design and cutting of stone (Coldstream 1991, 18).

Returning to materials, payments for lime (*calcis*) and sand (*sabuli*) for mortar feature regularly throughout the Rolls, and there are cases where further particulars are given in relation to these items which offer further insights into the construction process. The lime was probably purchased as quicklime, and in some cases the origin was Tadcaster (YML/E3/12; Stell forthcoming, 121) suggesting that a mortar based on burnt magnesian limestone was being used. This would have made economic sense, providing a use for the by-product of

quarrying and stone-working, whilst also supplying a materially compatible lime with the stone that was being used in building. Furthermore, there is evidence for lime-burning and brick-making on site at the Minster, with the purchase of sea coal for the process (*carbonum marinorum*) featuring under the same heading as the lime and sand (YML/E3/3; Stell forthcoming, 18). Other entries include the purchase of liquid measurers for limewash, as well as wax, pitch, tar and rosin to make cement for piecing-in repairs (e.g. YML/E3/6; Stell forthcoming, 49; YML/E3/22; Stell forthcoming, 272). Other trades, including carpentry, plastering, glass-working, plumbing and iron-working are given, but are less relevant to this study except where there are references that relate directly to the construction of the eastern arm. These are included in the discussion of the documentary evidence for the construction of Thoresby's east end which follows in section **3.2.4** below.

3.2.4 The construction of the East Front: the historical evidence

Having outlined the documentary evidence for the nature of the materials and craft practice employed on the Minster, it is now necessary to consider the literary evidence for the construction of Thoresby's east end. The historical reconstruction of this part of the Minster is well rehearsed. Browne (1847), Willis (1848), Harvey (1977) and Brown (2003, 138-141) have all drawn upon the medieval chronicle of Thomas Stubbs in their synthesis of the building chronology. Stubbs was a near contemporary witness to the first phase of rebuilding the eastern arm, and his successors continued to chart the biographies of the Archbishops from Thoresby onwards (Willis 1848, 7 n.p). This record of proceedings is therefore valuable in understanding the events leading up to and occurring during the remodelling of the eastern arm (Brown 2003, 138).

According to Brown (2003, 138) the decision to rebuild Archbishop Roger's choir had been considered prior to 1348, when Canon Thomas Sampson left a £20 donation in his will towards the fabric providing that work on the new choir began within the year. As Brown suggests, it is possible that a design had

already been formulated, even if Sampson's proviso suggests that work might be delayed. However, it is important to note that the term 'work' may have referred to a number of operations besides building, including the ordering and gaining of stone for what was to be a substantial undertaking. Indeed, the fragmentary Fabric Roll for 1350/1355 (YML/E3/1; Stell forthcoming, 2, 3) records substantial payments for the quarrying and carriage of stone, which may well have been intended for the new eastern arm.

Despite these initial plans for redevelopment, however, the project must have suffered from the demographic impact of the Black Death. The arrival of the plague in York in May 1349 meant the demise of both cleric and craftsman alike, and no doubt the Minster workforce were hit hard (Brown 2003, 138). John Harvey (1977, 157) suggests that the master mason Thomas Pacenham, who may have been involved in initial plans for the new eastern arm, may have been a victim of the plague. Another less-cited factor impacting upon the Minster was the demands made by the Royal works during this period. From 1346 until 1377, Edward III pressed masons from all over England, including Yorkshire, into service at Windsor (Lindley 1996, 140; Brindle and Priestley 2005, 222-223). Indeed, as the continuator of Ranulph Higden's chronical bitterly complained 'almost all the masons and carpenters throughout the whole of England were brought to [Windsor], so that hardly anyone could have any good mason or carpenter except in secret' (cited Lindley 1996, 140). Since Edward sought the best craftsmen in the country, it would not be surprising if some of these were drawn from the Minster. As a result, Archbishop Thoresby may not have been able to commence construction of the Lady Chapel any earlier than 1361. Indeed, thereafter, the number and calibre of the workforce may have continued to affect the progress of the campaign.

So whilst it appears that preparations may have been underway from the late 1340s onwards, the construction of the new eastern arm was not resumed until 1361. By now Thoresby had resigned from the government post of Chancellor, and could now focus his attention on work at the Minster. This is illustrated by a Brief of Monition of 13th February 1361 delivered by the Chapter. This brief was

issued to admonish the canons and clergy for the slow payment of a tax that had been imposed (probably in early 1360) 'for effecting the necessary repair and amendment of divers and known imminent deficiencies, as well in the choir and belfry, as in other parts of the said Church' (Regist.G.c. fol.43 cited Browne 1847, I, 147; Brown 2003, 139). Brown (2003, 139) suggests that this may be an indication that repair and refurbishment of the eastern arm had been considered, before being rejected in favour of complete reconstruction. However, if the purchases of stone in the 1350s mark the intention to rebuild the choir then it is possible that prior to the start of construction it was deemed necessary to undertake temporary or holding repairs to the structure. Moreover, since the construction of Thoresby's east end appears to have been designed to begin without wholesale disruption to the choir and presbytery, it was necessary to secure Archbishop Roger's twelfth-century sanctuary as well, which was not fully dismantled until the 1390s (Brown 2003, 169; Norton 2007, 140).

Finally, it is important to note how the choir and belfry (or central tower) are distinguished in the brief from the 'other parts of the said church'. This phrasing implies that whilst the rebuilding of these portions was still forthcoming, they needed to be included in short-term maintenance schedules. Overall, then, it seems unlikely that a mere refurbishment of the eastern arm was being considered. Rather, this document provides evidence of the need for the temporary repair of the structure whilst the choir and presbytery remained in use and that the plan to rebuild was now firmly in place.

By July 1361 the desire to begin construction work is evident, and it is possible that this decision would have been made slightly sooner were it not for a second outbreak of plague in June of that year (Hughes 1988, 136). An Indenture dated to the 20th July 1361 expresses the intention to rebuild the choir and provide a more appropriate space for the daily celebration of the Mass in honour of the Virgin Mary (Regist.G.c. fol.52 cited Browne 1847, 148-149; Brown 2003, 139). Whilst it is unnecessary to reproduce the entire document here, there are

several important statements in the Indenture which shed light on the rebuilding:

'there was no place in the said Church of York suitable for the becoming celebration of the Mass (in honour) of the glorious Virgin Mary, mother of God'

'and that the ancient choir, which has seemed to many persons of too homely a structure, in regard of the magnificence of the nave of the Church, should be by parts demolished… and the materials be converted to assist in the completion of the aforesaid new choir'

'it has been unanimously agreed and consented by the Archbishop and Canons aforesaid, that the Hall and Chamber [at Shirburn] be abolished and destroyed, and that the stones thereof, which are adapted to hasten greatly the completion of the fabric aforesaid, be applied to the more speedy finishing, through God's favour, of the same'

(Regist.G.c. fol.52 cited Browne 1847, 148-149)

Firstly, it would seem that the Archbishop and clergy were dissatisfied with the existing provisions for the celebration of the Virgin, a practice which had been enjoying an increase in national popularity since the thirteenth century. Raine (1859, 294-295) claimed that the Lady Chapel had been located in the crypt ahead of Thoresby's work, and Brown (2003, 164) has therefore suggested that the request for a new Lady Chapel could have been a convenient inclusion in the Indenture to legitimise the rebuild. This is supported by the fact that the Lady Chapel was just one element of a much larger whole. Occupying only the final bay of the Thoresby's east end, it was hardly the focus of the entire campaign. In fact, Thoresby's agenda stepped beyond the demands of mere liturgy. In the rebuilt east end the Archbishop sought to create a space within which he and his predecessors and successors could be more appropriately interred, and where his chantry could be established in spectacular fashion. Since the indenture also functioned as an appeal for funding, it sought to provide as many justifications as possible to merit the rebuilding of the eastern arm (Brown 2003, 164).

The second reason used in the Indenture to galvanise public feeling was the issue of aesthetics. Here, the Minster community expressed their unhappiness with the contrast between the 'ancient' choir of Archbishop Roger and the new nave. A letter of Pope Urban V issued c.1363 describes the old choir as 'unsuitable and disproportioned' and confers indulgences on those contributing to the rebuilding (Regist.G.c. fol.81b cited Browne 1847, 151-152; Brown 2003, 164). This description may well be justified, since the ongoing work of Norton and Harrison (forthcoming) is suggesting that Archbishop Roger's sanctuary incorporated a vestibule and corona-like extension beyond the high-altar. If this was the case, then the church would have appeared distinctly irregular in both plan and elevation, with a new, rectangular building to the west of the central tower, and an undulating, out-dated structure to the east.

The final element of the 1361 Indenture deals with materials, where it was deemed appropriate to re-use the stones of Roger's building for the fabrication of Thoresby's east end. The document also states that the redundant Archbishop's Hall and Chamber at Sherburn-in-Elmet should be dismantled. The re-use of stone from the Hall and Chamber at Sherburn-in-Elmet for the new eastern arm has already been highlighted by Brown (2003, 157), where stone recognised as being twelfth century in character in the present choir and Lady Chapel has been attributed to this source. However, the fact that the materials of the old choir were re-used in the new structure has yet to be fully appreciated. If the systematic recycling of stone from the twelfth-century choir can be identified within the extant architecture of the east end, it may help to shed light not only on the construction sequence of the East Front and Lady Chapel, but also the demolition of the earlier eastern end. Whether it is possible to differentiate these two sources of recycled twelfth-century choir material also needs careful consideration. This facet of the construction history of the East Front, and eastern arm in general, will be further explored through archaeological analysis in Chapter 4.

Only ten days after the Indenture, on the 30th July 1361 Archbishop Thoresby was able to lay the foundation stone of the new east end. This was probably a

ceremonial act, perhaps preceded only by the setting-out of the new work and the initial cutting of the main foundation trench. The laying of a single stone would not have required the entire foundations to have been dug. Indeed, it is far more likely that efforts at this early stage were being concentrated on the procedure for safely dismantling the uppermost stages of the eastern termination of the twelfth-century choir.

The generosity of Archbishop Thoresby, who made regular substantial donations to the fabric fund during the 1360s and early 1370s, ensured that the project proceeded with the desired speed and efficiency (Regist.G.c. fol.81b cited Browne 1847, 152; Regist.G.c. fol.62 cited Browne 1847, 152). By 1364 preparations were made for the arcades of Thoresby's east end. A memorandum records that a series of chantries located beyond the high altar were to be suspended or transferred (Regist.Xa. fol.36, etc. cited Browne 1847, 155; Brown 2003, 139). This included a number in the crypt of Archbishop Roger's building, as well as the altar of St John the Evangelist, beyond the high altar. This sheds light on two important aspects of Thoresby's project. Firstly, it suggests that a crypt space and superstructure existed beyond the high altar, and that this remained in use until 1364. Secondly, it seems likely that up to this point Thoresby's new work had progressed around the existing twelfth-century building without it being necessary to dismantle and fill-in its ground floor and basement. By 1364 the time had therefore come to clear the easternmost termination of Archbishop Roger's structure. However, the high altar remained in use.

The years 1364, 1366 and 1368 saw arrangements being made for the establishment of several new chantries in Thoresby's east end. On the 20th December 1364 the executors of Henry, Lord Percy made an agreement with the Archbishop for the support of four chantry priests to pray for the souls of the Percy family (Browne 1847, 155-158; Brown 2003, 139). Significantly, this chantry was to be situated at the altar of the Blessed Virgin, under the new east window of the Lady Chapel. Archbishop Thoresby also appears to have appropriated one of these chaplains for himself and his successors (Brown

2003, 139). In 1366 a second chantry was established for the soul of John Alkbarrow at the altar of St Stephen at the end of the north aisle, and a third to John de Stayngate at the uncertain location of the altar of St John the Baptist in 1368 (Regist.B.y. fol.47; Regist.T.c. fol.75 cited Browne 1847, 163; Brown 2003, 139). Although the chaplain, Richard de Langley, was admitted to the Percy chantry in 1363 (Browne 1847, 157 n1; Brown 2003, 139) it is hard to believe that these altars were really in active use during the mid-1360s. Thoresby's east end was still far from complete. The arcade approaching the altars would have been a building site, and the east wall itself was also still covered in scaffolding, both inside and out. These arrangements are therefore most likely to represent the reservation of spaces and preparations for the chantries, which could be activated when it was favourable to do so at a later date.

The year 1369 marks a significant change in personnel at the Minster. On 5th January 1369 the Chapter appointed a new Master Mason, Robert de Patryngton, to continue with the work (Thoresby's Regist. fol.324b cited Browne 1847, 162; Brown 2003, 161). This Indenture includes a number of important details about the terms of his employment and the circumstances in which he was appointed. Patryngton was to be paid £10 at the terms of Whitsuntide and St Martin in the winter, in equal portions, and was also given houses within the Close, 'which William de Hoton, mason, inhibited while he lived'. From this it has been assumed that Patryngton was replacing Hoton on his death, perhaps the consequence of the third plague outbreak of plague in 1368-1369. As master, Patryngton was employed for life and forbidden to work on any other projects other than the Minster. He was also offered a disability pension of ten marks, together with the houses, should he become blind or affected by 'any other bodily infirmity'. The Indenture also states that if he became incapable of physical labour, he was still expected to provide advice on the work.

Shortly after his appointment on 18th February 1369, a special contract was made with Patryngton for the production of six marble tombstones for Archbishop Thoresby's predecessors (Thoresby's Regist. fol.325 cited Browne

1847, 163; Brown 2003, 139-140). Browne (1847, 183-186) was doubtful that these tombstones were for the re-interment of the former Archbishops in or near Thoresby's new Lady Chapel, and posited that they were instead intended for tomb refurbishments in various locations around the Minster. However, the evidence presented in 1543 by John Leland, and later illustrated by James Torr (Ms.L1/7, 142^{r}-142^{v}) in the late 17th century, contradicts this view. Seven stones were recorded in the relevant locations before the Lady Chapel altar. One of these was Thoresby's own memorial which was added to the original Patryngton contract at the point of the Archbishop's death in 1373 (Willis 1848, 33). Furthermore, excavations undertaken in the Lady Chapel by Derek Phillips in 1968 exposed a number of burials adjacent to the altar, which no doubt represent several of the former Archbishops (Figure 12). All of this evidence again points towards the likelihood that Thoresby's agenda was not only to begin the rebuilding of the eastern arm for liturgical and aesthetic reasons, but also to secure a designated space for the special interment of himself, his predecessors and his successors (Brown 2003, 164-165).

The renewed survival of the Fabric Rolls in 1371 (YML/E3/2; Stell forthcoming, 5, 11, 13) sheds important light on how far the work had progressed since the laying of the foundation stone ten years earlier. Under the heading of quarrying costs there is evidence that the prospection for a new stone source was underway, with payments made for the clearing of the *nove quarere* (new quarry) at the start of the year, and an assessment of the eligibility and quantity of suitable stone by Patryngton (YML/E3/2; Stell forthcoming, 7). Two entries, referring to the *pictura celure supra magna altarem* (the painting of the ceiling above the high altar) and the *elevatione magna celure* (raising of the high ceiling) also indicate that work was now underway at high level. Brown (2003, 140-141) has argued that these items refer to the making good of the choir and presbytery vault at the junction between the old work and Thoresby's east end, and the raising of the new vault further east respectively. This interpretation would suggest that Thoresby's east end was structurally complete at the time of his death in 1373. Since the vault would not be inserted until the clerestorey walls were tied together by the roof, it indicates that Thoresby's work was at

least weathertight, and able to withstand the hiatus in building work that followed until operations to the western bays of the choir and presbytery resumed in the 1390s. Moreover, the fact that work to the ceiling was undertaken at the western extent of Thoresby's east end above the high altar also suggests that the new vault was also proceeding across all four of the easternmost bays. However, this is not to say that the rebuilding of the eastern arm was completed in 1371. The aisles still required their stone and brick vaults. These were not added until c.1420 according to their boss designs. The East Front too, was incomplete, for the Great East Window was not glazed until 1405-8 (Brown 2003, 141).

An inventory of goods included in the roll for 1399 indicates that by the closing years of the fourteenth century the stockpiling of glass was underway in anticipation of work to the *magnis fenestris* (great windows) of the new choir (YML/E3/3; Stell forthcoming, 23). This may have included the east window itself, with quantities of coloured glass featuring amongst stocks of *vitri albi* (clear glass) and ironwork. Of the clear glass, some 6300 *quarteron* (?quarries) were recorded, and it is likely that these were being used as a temporary glazing solution in anticipation of sponsors for stained and painted designs. If this were the case, then this may offer an insight into how the problem of blocking the east window had been solved between the construction of the masonry and the insertion of the glazing scheme some years later in 1405. This is recorded in a contract made on the 10th December of that year between the Dean and Chapter of York and John Thornton of Coventry for the making of 'a Great Window at the E: end of the quire' (YML/Torr Ms.L1/7, f7). Thornton was expected to have a direct hand in the execution of the work, which was to be completed in three years, and he was also responsible for the procurement of workmen and materials. The work was funded by Bishop Skirlaw, and although no record of his donation survives his generosity was commemorated by his inclusion, with armorial bearings, at the base of the window (French 2003, 5; Brown 2003, 220).

Following the completion of the main shell of the eastern arm, other architectural features, such as pinnacles, parapets and battlements, could also have been added much later, being clear of the rooflines of the central vessel and aisles. As late as 1475-6 the Fabric Rolls record the production of battlements and finials for the south side of the choir (YML/E3/27; Stell forthcoming, 359; Browne 1847, 255). Willis (1848, 38 n^{w}) notes the carving of large quantities of Huddleston crockets and gargoyles in 1479 and 1485, which he suggests were intended for the eastern arm (YML/E3/30; Brown 2003, 215). This addition, or renewal, of carved details is not surprising, and may well have been intended for the East Front itself given that the façade had by now been subjected to a hundred years worth of weathering at high level. Other finishing works continued inside the building, such as the plastering of the choir walls, and the rolls show that regular repairs to the Minster's glazing had been necessary for some years (YML/E3/6; YML/E3/13; Stell forthcoming, 46, 140). Within references to maintenance are important entries relating to the furnishing of the eastern arm, including a payment for a man to strengthen the stone images of the archbishops that faced the Lady Chapel altar (and presumably situated beneath the engaged canopies of the piers) in 1433 (YML/E3/13; Stell forthcoming, 144). It is highly likely that far more sculpture was installed in the choir than has survived, adding weight to Stubbs' acknowledgement that '[Thoresby], as a true lover of the Virgin, completed a chapel to her with wondrous sculpture and painting' (cited Willis 1848, 8).

The consecration of York Minster in July 1472 marks the end of the main construction campaigns at the cathedral (Brown 2003, 215). With the western and central towers nearing completion, work was confined to ornamentation and, increasingly, repair. The choir was refurbished ahead of the consecration, which may have included some structural and cosmetic reparations owing to a fire in March 1464 at the feretory of Archbishop le Scrope in St Stephen's Chapel (Harvey 1977, 186 cited Brown 2003, 236; YML/Torr Ms.L1/7, f11^{r}). As the fifteenth century drew to a close, so did the activity of the masons and carvers. No longer were they cathedral builders, but cathedral repairers.

3.3 Repairs and Maintenance c.1500-c.1700

3.3.1 Overview

The intense political turbulence of the sixteenth and seventeenth centuries was not compatible with any desire for unnecessary expenditure on the fabric of the Minster, and so section 3.3 is inevitably very short. In addition, the records for this period do not lend themselves to a detailed reconstruction of the routine repairs to the fabric either, since the Fabric Rolls that survive are only summaries of rents and disbursements that were originally accompanied by itemised trade bills and vouchers, now lost. Indeed, it took considerable time after the 1649-1660 Interregnum before the close supervision of receipts and payments was introduced at the Minster (Cross 1977, 245). For the fabric, there are no surviving bills until the mid-eighteenth century, and so where there are references to work and materials they are only very brief. Nonetheless, this period must be accounted for in the history of the East Front, and the references and drawings that do survive offer some useful insights into the intervening years between the end of the medieval campaigns, and the beginnings of the more rigorous alterations and restorations of the eighteenth century. Indeed, one valuable contribution of this period is the work of the Minster's first dedicated antiquarian, James Torr (YML/Torr Ms.L1/7), who compiled a thorough survey of the Minster between 1690 and 1691. This study focused on the form and subject matter of the Minster's interior, including its glazing scheme, heraldry and monuments, and has since become important for the study of the building. Torr also made valuable transcriptions of documents relating to the building of the eastern arm (already noted above) which have since become lost.

3.3.2 The sixteenth century

The early years of the sixteenth century saw the masons of the Minster sustained at around eight to twelve men. However, the opportunity for fashioning new work became increasingly restricted. For the first time in

centuries, there were instances when there were no purchases of stone (Raine 1859, 95, 107). The masons found some creative respite in the rebuilding of St. Michael-le-Belfry church between 1525 and 1536 (Raine 1859, 100; Pacey 2007, 130), but this was only to preclude a much more depressing state of affairs brought about by the Reformation. During the 1540s the Minster was stripped of its shrines, furnishings and statues, and the injunctions of Archbishop Holgate, the first bishop to openly accept the supremacy of the Crown and renounce Rome, included further alterations and removal of the Catholic images of the cathedral (Browne 1847, 294-297; Tindal Hart 2001, 102). The documentary sources suggest that these acts may have resonated through the local stone industry with great efficiency. Between the years 1503 and 1542 twenty-seven carvers and alabaster-men were admitted Freemen of York, but in the subsequent forty years there was not one (Stone 1972, 233). As Swanson (1983, 31) has argued, the end of major work on the Minster and the general cessation of large-scale construction in stone throughout the city could have initiated a contraction in demand for stone masons, and therefore a decline in the activity and output of the craft at the Minster.

Nonetheless, the cathedral remained a vast building in use and it therefore required regular maintenance. Repairs to the masonry, glass and roofs feature throughout the 1500s, although there are no direct references to the stonework of the East Front during this century. However, a handful of references in the Fabric Rolls indicate that some work had been undertaken on the eastern arm. Repairs were made at high level in 1570, when a Michaell Stedeman was paid 21s 4d for sixteen days' work 'mendinge the pynnacles and other places of the batylments' (Raine 1859, 115). Similar work followed in 1580 when a pinnacle on the north side of the choir was repaired, and in 1581 twenty-three days were spent working on the 'greate glasse windowe at the east ende of the quere' (Raine 1859, 118). While these references are brief and shed little light on the nature of the work or the materials employed, they are still of significance in indicating that the cycle of repair continued at this time, especially at high level.

3.3.3 The seventeenth century

Into the seventeenth century works to the glazing and roof-leads became the dominant themes of repair. Again, there are years where no stone was purchased, and indeed when no masons' work was undertaken (e.g. YML/E3/62/3 for 1623-24). The frustrating lack of trade bills for the period has already been noted. However, by the end of the century it appears that the increased political stability, both nationally as well as at the Minster, was accompanied by a renewed willingness to address the condition of the exterior of the building (Owen 1977, 249). Indeed, Dean Gale was committed to the exterior cleaning of the cathedral in 1685, and work continued on the roofs well into the 1700s. Unfortunately, in respect to information concerning the East Front there is virtually nothing. One exception is an item for the year 1682-1683 when there is a tentative indication that some intervention on the façade took place (YML/E3/65/26). In that year the master mason Edward Haggis was paid for 'dressing the east end'. This may have referred to work at plinth level connected with the re-laying of the pavement around the outside of the eastern arm.

While the accounts of the seventeenth century shed little light on the nature and extent of interventions to the fabric in these years, the period does offer the first pictorial representation of the East Front. In 1650 Daniel King published his *East Prospect of the Church of St Peter of Yorke* (Figure 13). The drawing attempts to illustrate the elevation to full height, although many of the elements are simplified and the perspective and proportions are distorted so as to emphasise the central vessel and the Great East Window. Within the first tier, the niches of the south and north-east stair turrets contain full-length statues. The southernmost figure bears arms on its outer niche-mouldings. Beneath the East Window seventeen heads are shown, their identities hard to discern save for a mitred character to the south and a king to the north. The artist seemed to have difficulty conveying the East Window itself, since the curvilinear elements of the tracery are wildly simplified with no figurative embellishment to the voussoirs of the arch. However, King does show the positions of the label stops

and the small heads at the transition of the main mullions to the tracery head. Within the niche at the head of the arch is a much distorted figure. It appears to face outwards to the east, robed and mitred with hand raised, perhaps in blessing. Above the niche, the central pinnacle is shown heavy, thickset and without extraneous ornament. The final detail of the drawing to note is the relative difference between the parapet gablet configurations along the aisle walkways to the north and south. To the south an order of six gablets is shown, but to the north there are only two. Since the present parapet configuration is roughly opposite to this, with fewer, larger gablets to the south than to the north, it is likely that the original printing block was not properly cut in reverse to give the correct inverted image on paper. If this was the case, then the mitred figure and king beneath the East Window could also be exchanged to correspond with their current locations.

3.4 Antiquarians and Architects 1730-c.1800

3.4.1 Overview

'As then this church was so compleatly finished, and that so lately that it is not yet four hundred years old, it is the less to be wondered that the work continues so firm and fine, that it is now the beautifullest church of the old building that is in Britain'

(Defoe 1727, Letter IX)

The eighteenth century marks a period of increased antiquarian celebration of York Minster alongside some of the more significant works to the fabric since its original construction. Overall, the continuing responsibility of maintaining the fabric appears to have lain solely with the Minster craftsmen until the involvement of the architect John Carr in 1770. Even then, Carr's responsibilities were comparatively superficial, being concerned with the overall condition of the building with a view to determining a repair programme and estimated costs. In the first decades of the century major renewal and renovation was focused on the interior of the building, with the

most notable work being the re-organisation of the choir in the 1720s, 30s and 40s, and the laying of the Burlington Pavement between 1731 and 1736 (Friedman 1995).

With regard to the exterior, only modest repairs and cleaning took place within the first half of the century under the auspices of Dean Finch. This is borne out by the summaries of the Fabric Rolls and contemporary accounts. In 1725, Edward Harley reported seeing 'a man employed for cleaning the walls on the outside, who has contrived a chair for that purpose which he fixes on any part he has a mind to and sits in it for the performance of his business' (cited Friedman 1995, 69). It is likely that this cleaning involved the removal of black sulphation from the walls of the building, which had been accumulating due to the proximity of coal-burning dwellings around and even against the Minster (Figure 14). This is supported by the comments of the antiquarian Francis Drake (1736, 486). He remarked on the removal of the sixteenth-century dwellings against the south transept's south wall. Once these were demolished, he noted that Dean Gale 'cleaned this part of the church from the Scurff it had contracted by the Smoke proceeding from these dwellings' (Drake 1736, 486; Owen 1977, 248; Bowler and Brimblecombe 1990b, 38). It would therefore appear that by the eighteenth century at least, there was already an awareness of the relationship between sulphur dioxide, or coal smoke, and the formation of black crusts, or 'Scurff', on the surface of the Minster's magnesian limestone. It also suggests that the deposition and decay process had also been occurring for some time, and that the cleaning of the stone was seen as an appropriate remedy.

In the second half of the century, concern about the condition of the fabric gathered momentum. The survival of numerous trade bills associated with the Fabric Accounts from 1757 enables a greater insight into the operations of the Minster workforce. Much of the 1750s was spent on the repair of the west end, including the west windows (YML/E3/123; YML/E3/124). However, the notes on the repairs indicate that work was fairly conservative. New mullions were masoned, while the tracery above was retained and repaired. Purchases for a

wash including hair and ochre were made, perhaps applied as a protective measure as well as a means of aesthetically unifying the old and new work. Time was also spent cramping, pointing and painting stonework at high level, as well as working new, and plumbers' work was undertaken on the roofs and many of the windows. However, despite the fact that work was ongoing, the Dean and Chapter were still concerned with the condition of the Minster's roof timbers, as well as other parts of the building. As a result the York architect John Carr was commissioned by Dean Fountayne to undertake a survey of the fabric between 1770 and 1773 (YML/E3/136; YML/A4(1)a2). Carr found many areas in need of repair or replacement and outlined a programme of necessary works that were to continue into the first quarter of the nineteenth century.

3.4.2 The East Front

Specific attention to the East Front begins with the work of the antiquarian Thomas Gent, who published *The Antient and Modern History of the Famous City of York* in 1730. Gent (1730, 34, 58) attributed the re-building of the eastern arm to Archbishop Thursby [sic] and provided a description of the East Front statuary. Gent's account is therefore very useful, not only because it is the earliest known, but also because the lowest pair of figures within the first tier of niches were removed during the nineteenth century. Gent identifies these statues as the fabric donors of Vavasour 'in his Knight Templar's Habit' to the north of the Great East Window, and Percy 'in his Robes, belonging to the Order' to the south. Above the Great East Window, Gent interprets the figure as Archbishop Thursby [sic] 'with his mitre upon his head, sitting in his chair, having in his left hand a church and pointing out with the two forefingers of his Right' (Gent 1730, 58). The author appears less sure of the subject of the heads below the sill of the Great East Window. They are described as a series of 'fifteen carved heads, seeming to be those of Priests, with the head of a crowned The carved voussoirs of the intrados of the Great East Window are overlooked, perhaps because Gent was unable to study the façade from a satisfactory viewpoint or because the carvings were obscured by surface soiling.

Six years later in 1736, Francis Drake published *Eboracum: or the History and Antiquities of the City of York*, the second volume of which was devoted to the Minster. Drake provided a useful description of the eastern arm, which to some extent borrows from the information given earlier by Gent (1730). Drake (1736, 486) also interpreted the seated figure above the Great East Window as Archbishop Thoresby, 'mitred and robed, in his Episcopal chair, having in his left hand the representation of a church, and seeming to point to this window with his right.' Interestingly, Drake viewed the hand of the figure in a slightly different position to Gent, who judged the right hand to be raised in blessing rather than pointing to the Great East Window. While one author may have had a better perspective of the statue than the other, it is also conceivable that the hand, and figure in general, was already misshapen from weathering and therefore open to multiple interpretations.

Drake (1736, 484-487) is rather more confident than Gent in his description of the heads below the sill of the Great East Window. These are the Saviour amongst the Twelve Apostles, flanked by Edward III to the south and a mitred effigy of Thorseby to the North. Drake reverses the position of the north and south niche figures with Percy attributed to the north and Vavasour to the south, with their shields of arms hanging by them. Despite offering this description of the figures, Drake was unable give a reason as to why he attributed the figures to the niches in the opposite order to Gent. This may imply that the arms, though present, no longer bore heraldry clear enough for either author to associate directly with the statues within the niches. Alternatively, it might be possible that Drake was drawing his commentary from previous engravings which contained errors or omissions, such as Daniel King's drawing of 1650 that bears the reversed details already noted above.

In his closing remarks on the history of the fabric, Drake (1736, 487) commented on the general repairs that had recently taken place. He notes the re-leading of the roofs of the Minster and the stopping up of 'all cracks, flaws and perishing of the stones, with excellent cement and mortar'. The pinnacles of the building were still in need of attention however, for Drake (1736, 487)

noted that only upon their restoration would the building regain its 'primitive lustre'. Drake's wishes were realised, at least in part. A later re-working of his book published in 1755 documents a number of new works, including the rebuilding of the head of the north-west tower, and, more importantly, the south-east pinnacle of the East Front:

'In 1745 the large South-East Pinnacle was thrown down by Lightning, and the prodigious Stones which composed it carried a considerable Distance: Another was soon after erected in its Place, in every Respect equal to the former.'

(Hildyard 1755, 143)

The description above does not identify precisely which of the two south-eastern pinnacles was destroyed. However, it is probable that this event relates to the south-east buttress, being the higher and more exposed of the two. The rebuilding appears to have involved new work, including a possible replica of the former pinnacle, or spirelet. The Fabric Roll for the year Martinmas 1745 – Martinmas 1746 (YML/E3/112a) shows that William Bateson the Mayson [sic] was paid the sum of £102/10s/0d for his services that year. There is no reference to the part of the building that he was working on at that time. However, this payment represents a considerable amount of work when compared to the remaining crafts listed in the roll. The next highest payment was £48/9s/0d to Leo. Terry the Carpenter. This suggests that a significant element of the fabric, namely the south-east buttress spirelet, was replaced in its entirety.

In the 1750s, while work was mainly focused on the western part of the building, some attention was also paid to the glazing and leadwork of the eastern arm. In 1757 Samuel Hick's smith bill includes a charge for 'nine new barres for the window of the quire' and in 1758 Richard Peckett carried out the re-leading of the roofs of the 'east end' (YML/E3/123; YML/E3/124). At the same time, work is reported to have been undertaken on the stonework of the Great East Window (Owen 1977, 251). However, there is no mention of this in the Fabric Accounts, and so the exact nature of these repairs remains unclear.

By the 1760s work appears to have moved round to the East Front proper, where there are references to both glaziers' and masons' work. In 1762 the glaziers spent 3½ days working on the East Window, alongside the 'high windows of the quire'. Other materials purchases in the 1760s show that putty and linseed oil were in use by the glaziers, presumably as a means to seal the interfaces between the glass panes and the stonework (YML/E3/126; YML/E3/128).

In regard to masons' work, during May 1762 Robert Sisson undertook the complete renewal of the 'battlement at the East End of the Church finished with seven pinnacle' (YML/E3/130). This was the parapet above the eastern termination of the north aisle. Four years later in 1766, further repairs to the façade are itemised. Sisson's bill records 'taking down the battlements and small pinnacles on the east end and making them good agane' (YML/E3/132). In this case it would appear that dismantling and re-fixing had been favoured over renewal. However, the same did not pass for the lower parapet on the south side running into the south-east turret. In this instance, a charge was made for 'working [a] new battlement on the south side and steps of the East End' (YML/E3/136).

It would therefore seem likely that all of the parapets of the East Front had received some form of repair by 1770 when the Dean and Chapter commissioned John Carr, architect and Lord Mayor of York, to prepare a report on the condition of the Minster and an estimate of the cost of repair (YML/A4(1)a2). Carr produced his survey between 1770 and 1773 and specification of works that resulted marked the beginning of a more systematic approach to the repair and replacement of the fabric of the cathedral. The importance of Carr's survey cannot be overstated, for it is the earliest surviving condition report of the Minster. It provides a detailed snapshot of its appearance before the substantial nineteenth-century interventions that were to follow. Carr's survey shows that he makes no plans to embellish or re-order the building. Rather, the report deals explicitly with the condition of the cathedral and recommendations and estimates for repair, with each part of the

Minster dealt with systematically. In addition, copy YML/A4(1)a2 of the report bears a number of additional annotations in pencil. These simple annotations appear in a roughly contemporaneous hand as either 'Done' or 'Not Done'. Despite their simplicity, they are an invaluable record of whether Carr's instructions were carried out and how the Minster workforce were being guided by Carr's survey. They also serve as an indicator as to whether or not the instructions were subsequently carried out. In sum, Carr's work introduces the concept of the architect-led repair plan, which operates to this day in the form of the Quinquennial Inspection regime.

Here it is worth setting the eastern arm in the context of the overall condition of the Minster c.1770. Carr's survey provides clear evidence for Gent and Drake's suggestions that the Minster fabric was continuing to deteriorate in the eighteenth century. On the exterior, considerable amounts of the stonework were in poor condition, with more decay noted on the southern side of the building than on the north. The pinnacles of the south nave clerestory were 'wanting', and although some of the parapet had been newly repaired, other areas still needed pointing and cramping with the addition of some new stones. The easternmost window of the clerestory is described as 'an ugly decay'd wood window, which ought to be stone', suggesting that earlier repairs had been rather makeshift. The remaining windows at this level were also suffering decay, although Carr recommended that they simply be cleaned and pointed and the decayed places filled up with good 'plaister' as opposed to being replaced. On the north side, a similar state of affairs prevailed. Again, the window nearest the tower was made up of wood suggesting previous structural failure on both sides. This is supported by the fact that Carr also noted large cracks in this wall and its windows. Earlier works teams may have replaced the easternmost windows to the north and south with timber rather than stone because they were uneasy about the stability of this part of the building. At aisle level on the north side, the wall was in better condition than those at clerestory level, with only pointing and cleaning required. However, to the south, the pinnacles were 'much decay'd', as were parts of the windows that were ordered to be fixed with 'coarse plaster to keep out the wet'.

Unsurprisingly, the west end of the building exhibited the symptoms of decay. The 'ornamental parts' were noted as being in poor condition, especially the 'Great [West] Door' and the adjoining niches. Since these elements are multi-faceted, it is understandable why these areas were suffering from what amounted to a sheltered decay mechanism. The upper sections of the western towers were also in need of repair or new work to replace missing pinnacle sections, while the belfry windows were noted as being only of brick and plaster.

Turning to the transepts, the north was considered to be in good condition, although Carr made significant observations about its structural state. He noted that the clerestory wall and interior pillars and arches had distorted under the pressure of 'the sinking of the middle tower'. This is worth noting, since it suggests that the movement that was to cause such concern to Sir Bernard Feilden (1976) in 1967 had been occurring for nearly two hundred years at least. Carr, however, expressed little concern at this time, which may suggest that the situation was not as bad as it was in the late 1960s. Nevertheless, this highlights the need to pay equal attention to early surveys of buildings, and not just those created in the era of the Quinquennial Inspection, so that a better understanding of the time-depth of problems is obtained. Carr stated that 'there is no danger to be feared at present from these circumstances, [though] some cracks in this wall should be filled up'. However, it appears that this was not carried out within this sequence of repairs as the task remains un-annotated. Cosmetically, the south transept was in a worse state than its northern counterpart, being 'very much decay'd in places'. Again, the ornamental, faceted work of the exterior appears to have deteriorated most, with much of the lower section in poor condition, notably the south door and windows and their related columns.

Having considered the general state of the fabric, it is now possible to set Carr's description of the eastern arm within this overview. The plinth or 'bottom basement' of the East Front itself was noted to be in very bad condition, with the recommendation that 'many decayed stones should be taken out and new

ones put in their places, and the whole thereof should be well pointed' (YML/A4(1)a2, 5). Parts of the Great East Window mullions were in need of repair (as opposed to replacement) and pointing on the outside. Furthermore, the mullions also required attention on the inside of the building, where Carr suggested that they 'may be preserved from further decay by a good coat of plaister [sic] being put on the decay'd places' (YML/A4(1)a2, 5). The ornamental work was also a problem at the east end. The heads of the 'towers and pinnacles were very much decay'd and out of repair', along with the 'Top part of the Stair Case at the South East Corner' (YML/A4(1)a2, 5). However, though out of repair at the time of Carr's report, this was most likely dealt with by Sisson shortly after the survey during the parapet works already noted above.

According to the pencil annotations added later to the report, the recommendations for the East Front were subsequently completed, as were those to the north and south clerestory walls, and the south aisle wall. On the north clerestory wall, Carr's attention was drawn to a 'great Crack' over the easternmost window, which was ordered to be 'well filled-up and pointed'. Though the outer screenwork of the fourth window, adjacent to the choir transept, also required cleaning and pointing, the remaining wall, windows, parapet and pinnacles were judged to be in good repair. In contrast on the southern side, the screen-work of three of the windows was 'exceedingly out of repair', as were the windows behind them. Carr is imprecise about which three windows he is referring to. However, it is probable that they are those of the first three bays from east wall westwards, because those running towards the central tower were noted as being in good repair. In the case of the decayed screenwork and windows, Carr recommended that all should be cleaned and pointed, along with the replacement of many of the mullions with new stones. Five of the pinnacles on the southern side were also lacking their ornamental finials. These appear to have been reconstructed as this work was annotated as 'Done'.

The south aisle wall of the choir and Lady Chapel was also in poor condition. The two westernmost windows before the central tower were 'so much decay'd, that a great many parts thereof should be well cleaned and pointed' (YML/A4(1)a2, 6-7). The interior faces of three of the aisle windows towards the east end were also unsound, as were several of the pinnacles and the base of the wall. These pinnacles were to be pointed and repaired with new stones where necessary. Only the north aisle wall remained unrepaired during the phase of works that followed Carr's survey. Here, three of the pinnacles had lost their ornamental tops, with a further three requiring cramping and pointing 'to preserve them' (YML/A4(1)a2, 6).

On general inspection of the interior of the building, Carr found little in the way of urgent masonry defects, save for the bases of some of the pillars, the stone benches against the walls, and several of the marble columns. However, the roofs of the Minster were a different matter, where holes prevailed in the east and west ends of the 'middle aisle' (presumably the eastern arm and nave), and in the south transept. Such was the precarious condition of these roofs that they were made priorities for restoration and this was undertaken between 1770 and 1788 (YML/A4(1)a2, 6,8; Owen 1977, 249). The timber-framing and lead covering above the nave vault was judged by Carr to be in a very bad condition (YML/A4(1)a2, 1). It was eventually renewed in its entirety by Joseph Halfpenny from 1795 (Owen 1977, 250). Around the same time, Halfpenny (1795) also embarked on the first major recording programme of the Minster's decorative motifs. This culminated in the publication of his work as engravings in the *Gothic Ornaments in the Cathedral Church of York.* This included a representation of the upper section of the East Front (Figure 15), complete with the carved voussoirs and an interpretation of the seated figure in the apex niche. The figure is given by Halfpenny as a mitred ecclesiastic, with the right hand raised and the left clutching what appears to be a much-simplified model of a building.

Returning to the works to the fabric, the leads of the east end were repaired again during 1795, the vault of the eastern arm was redecorated, and much

plasterers' work was done. This included repairs to 'the broken ornaments of the capitals and the East window' (YML/E3/159/V). During the roof repairs in 1793 attention was also paid to cleaning and painting the interior of the Minster (YML/E3/159/V; Browne 1847, 318; Owen 1977, 249; Bowler and Brimblecombe 1990b, 39; Phillips 1999, 26). As Charles Wild (1809, 3-4) noted, 'the whole interior was washed over with a composition of quicklime and yellow ochre, in a ratio of twenty to one, mixed with stale milk and water; the tone of which is extremely agreeable and incomparably preferable to the rawness of plain white'. Wild was comparing the virtues of a coloured treatment over plain limewash, perhaps indicating that the walls of the Minster still showed signs of earlier paint finishes. In tentative support of this, Browne (1847, 318) was later to lament that the 'remnants of former embellishment' had indeed been lost during this process of cleaning and limewashing.

A significant development in the repair history of the cathedral came during the year Martinmas 1787-1788 when William Shout became master mason (YML/E3/153). No longer confined to just battlements, windows and pinnacles, Shout's first project was to oversee the first documented wholesale restoration of one of the Minster's facades, a phase of work unaccounted for by previous scholars. Between 1789 and 1794 the south elevation of the south transept was restored in stages, perhaps to a new design as it is referred to by Shout as 'the new Gothic Front' (YML/E3/153V; YML/E3/154V; YML/E3/155V; YML/E3/156V; YML/E3/159V). Amongst purchases of stone for the work are bills for chaldrons of lime, loads of river sand, and hair, presumably for plaster. Also included are painters' bills for white and black paints and 'prepar'd oile' (YML/E3/156V; YML/E3/158V). Since these materials were being supplied to the masons, it is possible that paints were being used to refresh existing stone, to tone-in new with old and, in the case of the oil, to preserve existing stone. Oil-based coatings were certainly in use as a common method of stone preservation during the eighteenth century, as evidenced by Robert Mylne's specification for the use of boiled linseed oil on decayed stone at Canterbury Cathedral in 1768 (CCA/DCc/Fabric/S/22c, 5). It seems that by the 1830s, the use of linseed oil, stone coloured paints, resin, wax and Roman cements had all become part of the

masons' repair repertoire at the Minster (YML/E3/169/1; YML/E3/171; YML/E3/173; YML/E3/199V; YML/E3/202V).

3.5 Fires and Restoration – The nineteenth century

3.5.1 The first 25 years

William Shout's tenure ran parallel with the continuing rise in scholarly interest in the architecture of the Minster and its representation. In 1809 Wild published his *Twelve Perspective Views of the Exterior and Interior Parts of the Metropolitical Church of York,* which includes a commentary on both the form and condition of the Minster's architecture, and the works that had recently taken place. A general statement is made on the state of the exterior ornament, where 'time has nearly obliterated these interesting devices' (Wild 1809, 4). Wild goes on to commend the plan to renovate these, a scheme 'that has been so rigidly and successfully adopted by the master Mason' (Wild 1809, 4).

Of Wild's views of the Minster, that of the East Front (Wild 1809, Plate 12; Figure 16) is noteworthy as a record preceding Shout's interventions. The façade is depicted from the south east and shows the masonry as regular blocks, suggesting the implementation of a certain degree of artistic licence. This would also seem to be the case in Wild's treatment of the aisle parapets, as they are shown symmetrically with seven gablets on each side despite the fact that as far back as 1650 only four gablets existed above the south window (see Figure 13). However, other details appear to be accurate representations of the nature of the East Front at this time, particularly where certain parts are shown as damaged or missing. Had the artist been aiming for a fully utopian representation, it is conceivable that such features would have been omitted. For example, the north central pinnacle is without its ornamental parapet at the base of its pinnacle, a number of the central parapet gablets lack their finials, and the crown and cross of the centre gablet containing the seated figure is also absent. In sum, these features of the drawing of the façade suggest that certain vulnerable elements of the design had not been maintained, with the loss of

masonry and details apparent at high level. Other important aspects of the drawing include the presence of two, full-length figures within the outermost niches of the first tier and a seated figure within the gablet of the Great East Window. Not one of the figures is particularly detailed, which supports the earlier descriptions of Gent (1730) and Drake (1736) when the figures were probably already very weathered.

3.5.2 The nineteenth century work of William Shout

Overview

The early nineteenth-century Fabric Accounts are complemented by the Day Book of William Shout (YML/E10), which sheds further light on the masons' work between 1st January 1805 and 8th July 1826. During these years it appears that the Dean and Chapter were to remain committed to improving the appearance and setting of the Minster, first under Dean Markham and then under Dean Cockburn (Chadwick 1977, 273).

Although sporadic in its coverage, the Day Book is important as an additional commentary on Shout's progress around the Minster, the arrangement and practices of the workforce, and for details relating to the origin and use of materials used in the restorations, including stone. As a consequence, the Day Book is an important volume as it provides the first opportunity to identify specific sources of stone gained for the Minster since the medieval period. Furthermore, the book has the added value of containing margin annotations by Shout himself, which pertain to particular details of working practices and restoration projects. Through these notes it is possible to see that whilst being principally engaged at the Minster, Shout and his team also undertook outside commissions that encompassed headstone production and repairs to other churches, including Bolton Percy, Topcliffe and St. Michael-le-Belfry in York (YML/E10, 31, 81, 109). Importantly, while Carr's survey provided the overarching agenda for the repairs to the fabric, it seems that Shout was still very much in control of the stone-by-stone treatment of the Minster stonework.

The context and understanding of Shout's work is also enhanced by the increased antiquarian interest in the Minster in the early nineteenth century, represented by John Britton's seminal work *The History and Antiquities of the Metropolitical Church at York* in 1819. Britton's account is of immense value to the understanding of the cathedral, not least because it includes a substantial number of drawings of the architecture made prior to the major changes brought about in the nineteenth century (Figures 17 and 18). Although he avoids making any detailed references to Shout's restoration programme, Britton (1819, 44-46) offers an insightful narrative of the exterior and interior of the East Front and Lady Chapel, along with three engravings to which the author attaches an important caveat:

'the critical spectator seeks in vain for places to view the west end, the south side or the east end. He cannot see the whole of either from any one station: and if he wishes to represent them in drawing, he must sketch the parts from various points, and combine and display them by the rules of art… At the east end of the church, some houses approach it within a few yards; as they do at the west end, and south-west angle.'

(Britton 1819, 37-38)

Britton's statement is critical in evaluating the eastern arm at this time, as it tests the validity of both his own and previous visual depictions of the East Front. While some details may have been recorded quite faithfully if visible from a certain angle, other elements may have been omitted or enhanced, with the whole created from an 'imaginary station' (Britton 1819, 44). In essence, these drawings are representational and must therefore be used alongside corresponding descriptions to maintain any sense of reliability. It is, however, important to note that neither Britton, nor the artists before and after him, were able to capture the East Front effectively because buildings were in the way. It is highly likely that these buildings were coal-burning properties, just like those that had existed along the face of the south transept. They would therefore have been an immediate source of sulphur dioxide exacerbating the decay of the East Front masonry. While other such buildings against the south transept and North

West Tower had been demolished (Britton 1819, 39), those adjacent to the East Front were to remain throughout the nineteenth century. The East Front may therefore have been exposed to higher levels of adjacent pollution for a longer period of time than other elevations of the Minster.

Britton's (1819, 45-46) statements on the ornamental aspects of the East Front add detail to the understanding of their form and condition. The arch of the Great East Window is described, with its 'fine sweeping ogee moulding with foliage canopy, remarkable for its fine curve and lofty termination'. The fact that the carving within the intrados of the window is given simply as foliage is intriguing. Britton may not have been able to see the carvings to identify them as kings, foliage, canopies and lions. This is possible, given Britton's comments on the poor views that were available of the East Front. Alternatively, the carvings were illegible because of further gypsum encrustation or decay. The seated figure remained above the east window, as did the statues of Vavasour and Percy within the lower niches. In the case of the seated figure, Britton (1819, 45) hints at its ambiguity, and therefore weathered state, as 'a figure of an archbishop, seated, holding a church in his left hand, and his right raised; much larger than life.' More detailed descriptions of the Vavasour and Percy figures follow:

'A statue of Vavasour is in tolerable preservation: it has a belt, a short doublet, and hose or boots, drawn up above its knees, but no mantle: the countenance is that of an elderly man. Another statue, which seems to have been a graceful figure, but now reduced by the weather to a ragged appearance, is said to represent Percy: he wears a mail gorget and mantle; his helmet, on which stands a lion (his crest), is on the top of the niche; and a lion, or dog, is at his feet. These two figures hold in their right hands samples of their benefactions to the church.'

(Britton 1819, 45)

Both were clearly in a weathered, and perhaps decayed state, with Percy the worst of the two. Perhaps the most significant element of Britton's description

of the figures is the reference to the lion crest and helmet as a means of identifying the statue below as Percy. This feature is unique to the niche, and is therefore fundamental as a means of placing the figures in their correct positions on the façade, particularly as the figures are now lost. In Britton's drawing of the East Front, this position of this feature is confirmed, along with the presence of the shields that were formerly suspended alongside the north and south niches and described earlier by Drake (1736, 484-487).

Shout's Daybook: working practices in the nineteenth century

At the beginning of Shout's Daybook in 1805, works were concentrated on the western end of the Minster on the North-West Tower's north-eastern angle (YML/E10, 1). These works appear to have been undertaken from a localised scaffold, for the tower's north-western angle was scaffolded separately in March of the following year (YML/E10, 2), followed by the north-west buttress in May 1808 (YM/E10, 30). Similarly, the same approach was followed on the South West Tower in 1814 and 1816, with the scaffolding of the south-western and south-eastern angles undertaken separately (YML/E10, 105, 131). This practice is significant in the history of construction and repair practice at the Minster. It reflects the fact scaffold systems were once very fluid, moving around the face of the building as work progressed. In this way, areas of stonework could be tackled locally, without entailing the expensive and time-consuming practice of scaffolding and obscuring an entire façade. Further areas of the building were dealt with in much the same way. Moreover, it was the masons' responsibility to build the scaffolding systems that were used, rather than labourers. This suggests that it was probably respected more as a skill in Shout's time than it is today.

The workforce initially comprised approximately eighteen men, with this number fluctuating depending on the comings and goings of itinerant labourers. Rates of pay ranged from 3s/6d per week for William Shout to 1s/6d for a labourer, with each man first working six days per week, and then seven from

26th April 1806 (YML/E10, 2, 6). As had been the case in the medieval period, the year was split into two seasons, with 'candle light' operating between October and February (YML/E10, 78, 88). The exact meaning of 'candle light' as a work pattern is unclear from Shout's book, although it is likely from a number of references that it relates to the men working indoors by candlelight during the winter months 'from seven in the morning to seven at night' (YML/E10, 101). In 1807, an annotation notes that the men had 'begun to work with candle light 9th Nov should a begun 19th Oct. 13th Feb to give up candle light' (YML/E10, 26). The fact that the beginning of candle lit operations is delayed in this instance may indicate that work that could not be undertaken in artificial light, i.e. outside, was running over time. In tentative support of this, no exterior works to the Minster are noted within the candle light months during the years that are covered by the Day Book.

Shout made regular trips by horse and coach to the quarries in the Tadcaster region to personally select stone for his restorations (YML/E10, 46, 49). The main suppliers at this time were Michael Drake and Thomas Archbell. They operated from a small group of quarries south and east of Tadcaster as limeburners, quarrymen and stonemasons (Brooke 1976, 63-64). Stone was also gained from Bramham Moor (which may have encompassed Smaw's quarry) and Scott's quarry. For the most part, however, Drake and Archbell remained the regular source of magnesian limestone for the Minster until the 1840s (YML/E10, 103).

When considering the mortars for the Shout's restorations, the Day Book yields important evidence for the materials used. Purchases of 'chaldrons' of lime were made, and 'loads' of river sand, most probably from the Ouse, were gained for aggregate (e.g. YML/E10, 270; YML/E3/168). In the knowledge that local lime-burning operations were ongoing at the Tadcaster quarries, it is likely that the early nineteenth-century mortars were dolomitic and, furthermore, that they were 'hot-mixed'. This is borne out by the use of the term 'chaldron', being a standard dry English measure equating to 36 bushels (Chambers 1728, 188). The use of this unit suggests that the lime was being delivered in dry-lump form

as quicklime, which was then 'slaked', or 'hot-mixed' with wet sand in a single process before its use in the repairs. This would have made economic sense, since, on reaction with water, quicklime can expand up to three times its volume, thus giving three times as much product per load than if a pre-slaked putty or dry hydrate was being obtained in the same unit (Lynch 2007, 104).

From 1815 the minster masons gradually relocated to a new yard opposite the west end, and by 1823 this was equipped with facilities to produce quicklime (YML/E10, 119-120; YML/E3/182). In June of that year a Richard Backhouse was brought especially to York from Tadcaster to fill and burn two 'stills' of lime, which produced ten chaldrons of quicklime each (YML/E10, 255-256, 261). The term 'still' is likely to have been an abbreviation of 'distillery', and since the lime was being burnt it is conceivable that these were in fact lime kilns, with at least three functioning by December 1823 (YML/E10, 261). The intensity of stoneworking would have been producing a substantial amount of waste stone, all of which would have been an immediate source for mortar production. Once again, the practices of the early nineteenth century masons at York reflects a degree of simple resourcefulness and economic efficiency, whilst also indicating that a lime mortar derived from magnesian limestone was in use.

The East Front

While Shout's restoration of the western façade is well supported by the written record, the same cannot be said for the work that was undertaken on the East Front. While the overhaul of this facade is believed to have taken place in the 1820s, there are no surviving bills or vouchers to enhance the understanding of exactly what was done during these years. Near contemporary commentaries focus on the restoration of the Great East Window (YML/Add.Ms 93/2, 193; Browne 1847, 319-320) and this is the only part of the façade to be mentioned by Shout in the Daybook. On 26th April 1824, 8¾ of a day was spent 'working a springer for the first transom Great East Window' (YML/E10, 266). This entry relates to the replacement of a stone, or stones, at the level of the internal walkway of the east window after the erection of the first of two scaffolds

(inside and out). The second was erected later that year. On 5th July 1824 seven masons began to scaffold to the Great East Window, with the task complete only twelve days later on the 17th July (YML/E10, 269). The speed in which the masons erected this scaffold suggests that it was again localised to the centre of the facade and that it probably contained fewer standards, or lifts, than a scaffold of today. The final reference to the East Front in Shout's Daybook suggests that consideration was still being paid to the east window two years after the scaffold was erected. On 1st May 1826 Shout makes a note that coloured glass was required for the 'East Window', including 10 feet of red (YML/E10, 201). The fact that attention was now being paid to the glass could indicate that any repairs to the tracery or mullions of the window were now at an advanced stage.

Fortunately, a number of Shout's original working drawings for the East Front still exist. These drawings are some of the earliest in the York Minster Archive which deal with the early nineteenth-century restoration of the building, items which significantly enhance the understanding provided by the Daybook and Fabric Accounts at this time. Of particular value is that the drawings shed further light on the *extent* of Shout's work on the East Front. While contemporary and later commentators tend to focus on the work to the main window, the drawings show that Shout was gradually making his way across the façade from the south to the north side. As has already been noted above, all of the Minster's pinnacle and battlement work had been a concern of John Carr in the 1770s. The survival of Shout's setting-out drawings of many of these elements shows that large-scale pinnacle repairs and high-level work had been central to the masons' work for much of the early nineteenth-century. The East Front was no exception, with the indented arcading over the east window of the south aisle restored from the 1820s onwards (YML/3/5; Figure 19), along with a number of the decorative elements of the south buttress of the East Window (YML/3/9; YML/3/13; YML/31/276; Figures 20-22). This was followed by the East Window itself, along with the restoration of the panelling and gablets above, before, or at the same time as the replacement of some of the detailing below the corona of the north window buttress (YML/31/279; Figure 23).

William Shout died in 1827, indicated by a payment in the Fabric Accounts to his executor for two monthly bills due to the masons (YML/E3/191 [A]). It is from here that restoration work appears to have paused, initially because of the construction of the New Deanery (YML/E3/191 [A]) and the cleaning of the choir in 1828 (YML/Add.Ms 92/2, 156). A lengthier hiatus then followed as a result of the great fire in the choir that took place in February 1829, an event discussed in greater depth below.

The most useful Shout drawings for the East Front are those associated with the Great East Window itself, which was restored between 1824 and 1827. Starting at sill-level of the window and working up, drawing YML/31/290 (Figures 24-26) shows Shout's initial recording of the dimensions of the lower section of the window. The upper part of the drawing is damaged, although YML/3/16, (Figures 27 and 28) of the window-head helps to mitigate this loss of information. Drawing YML/31/290 suggests that Shout was anticipating the renewal of considerable amounts of the lower section of the stonework. Measurements and small-scale mouldings are taken for all of the key elements. These include the main sill and stoolings of the mullions, and the trabeations linking the outer masonry to the inner screenwork. The size and position for the glazing panels, presumably to inform their correct reinstatement, is also recorded in the northernmost section. Drawing YML/3/16 (Figures 27 and 28) shows a more detailed outline of the work that was being planned for the head of the window. Full dimensions for the window casement were taken, and it appears that the outermost order, or main hood-mould, was to be renewed in some way. These stones are individually numbered, and although it is only the south side of the casement that is shown in detail, it is likely that the replacements were mirrored on the north side. The apex, niche and central pinnacle of the window are included. However, the seated figure remains absent, perhaps because its restoration was not considered within these renewals. The mouldings of the panelling around the window casement were to receive substantial attention (YML/31/281, Figure 29), along with the parapet gablets above. Here, only half a gablet is shown, but this, coupled with details

shown in YML/3/43 (Figure 30) would have provided all the necessary information to entirely renew the parapet on its north and south sides.

Several large-scale setting-out drawings for the east window details also exist, which pertain to the moulding profiles of the window masonry (YML/4/1/9; Figure 31) and key intervals of the lower section at the levels of the transoms (YML/31/277; Figure 32). For the upper transom, drawings for stone renewals at gallery level are shown in Figures 33 and 34 (YML/31/298; YML/31/299), where attention was paid to the mullions and arches of the interior screenwork, as well as to the gallery itself. Unlabelled and undated part-drawings of the tracery of the window also survive (YML/31/292; Figure 35), which may also relate to Shout's work, especially as the scaffold was erected to the full-height of the façade to incorporate the parapet replacements. Other than the obvious problems of weathering and decay, it remains unclear from the archive as to whether or not there were any other reasons, such as structural trauma, that necessitated the replacement of so much of the East Window stonework. The problems of interior decay that had already been noted by Carr in 1770 go some way in explaining why the interior gallery of the screenwork had to be replaced. The plastering-up of the mullions had previously occurred under Shout, but, as was reported in June 1824 in the *Yorkshire Gazette*, the window was now in a 'dilapidated condition' (YML/Add.Ms 91, 281). At the time of the report, it was envisaged that the window was 'to be entirely taken out and replaced', thus necessitating the blocking of the aperture while the new work was prepared.

In sum, it would appear that the materials, working practices and restorations associated with Shout can be reconstructed from the archive to a considerable degree, both in terms of resolution and certainty. By combining the information found in the Fabric Accounts and Day Book with the architectural drawings and published accounts, it can be seen that Shout's contribution to the intervention history of the East Front was substantial. A significant amount of high-level and decorative work on the south side of the façade appears to have received attention in his time, along with the restoration of the main masonry elements of the Great East window. In this case, it would seem that the whole of the lower

section of the window between sill and tracery level was replaced, along with the possibility of work to the tracery head before the restoration of the central pinnacle and parapet. Alongside the replacement of stone, the archival evidence suggests that *in situ* repair was also a long-standing practice within the masons' workshop, with purchases of plaster and protective media, such as linseed oil, frequently occurring in the fabric accounts.

The consequences and implications of Shout's work were not immediately made apparent, but further insights into this period of intervention begin to emerge in the literature that grew in the wake of the fire of 1829. Furthermore, as the masons began to return to Shout's work in the later nineteenth century, time and changing attitudes to repair gradually brought the early phases of the Minsters' restoration into question. In the 1840s, time was spent correcting some of Shout's work to the West Front, and by the early 1900s the body of criticism had become particularly uncompromising. However, before these retrospective views of Shout's work are considered, it is necessary to explore the repairs that followed after the first of two nineteenth century fires at the Minster.

3.5.3 The 1829 fire

A fire started by Jonathan Martin on Sunday 1st February 1829 all but destroyed the interior of the eastern arm of York Minster (Chadwick 1977, 274-275). This catastrophe was well documented by several contemporary authors, who described how Martin had hidden in the church into the early hours of the night before setting fire to two piles of prayer books - one against the Archbishop's throne, and the other near the organ and choir stalls (Wylson 1845, 158). From these points the fire progressed upwards and eastwards, destroying the roof, stalls, pulpit and throne (YML/B3/3/1, 5; Chadwick 1977, 275). A fire of this scale in the choir raises questions about the extent to which Thoresby's east end, East Front and Great East Window were damaged. Indeed, previous anecdotal assessments of the nineteenth century stone in these areas have been attributed to post-fire repair, and so it is important to ascertain the true extent

and significance of these works. As will be seen, the accounts of the restoration that followed shed significant light on the subject, along with supplemental information found within the work of John Browne (1847).

In the aftermath of the fire, a Central Committee was formed to manage the restoration of the choir and to raise subscriptions (YML/B3/3/1; YML/B3/3/2). The architect, Robert Smirke, was appointed by the Dean and Chapter to survey the damage, advise on the best means of repair, provide an estimate for such works, and to comment on the general state of the Minster (YML/B3/3/1, 4). Interestingly, the appointment of Smirke closely parallels that of John Carr in 1770. Again, an architect was being used to organise a substantial programme of work that would ultimately still lie closely in the hands of the craftsmen. As the scale of the maintenance burden on the cathedral grew over the ensuing years alongside the growth of ecclesiastical architecture as a profession, it appears that this situation became the established norm.

Smirke's 'Report Upon the State of York Minster' was presented to a meeting of the nobility and gentry of the city of York held on Thursday 5th March 1829, whereby the best means of funding the project were subsequently considered (YML/B3/3/1, 7-10). The first part of the report outlines his observations on the nature and limit of the injuries to the building, which correlate with several drawings that were made in the aftermath of the fire. While the external walls of the choir and the chief part of the side aisles were uninjured, everything within the main vessel of the choir had been destroyed (YML/B3/3/1, 5). This is borne out by a contemporary print of the interior after the fire produced by John Browne (Figure 36), which depicts the exterior head of the East Front without its decorative corona around the north spirelet. Inside, the stone screen behind the High Altar had been severely damaged and required dismantling and rebuilding anew. Most of the Lady Chapel pavement had been lost, due to the burning roof timbers crashing down upon it. The clustered columns of the arcade piers were also badly affected, with those adjacent to the heart of the fire in the choir stalls considerably worse than those of Thoresby's east end. The

surface of these columns were in ‘a very shattered condition’ and required rebuilding, but Smirke believed that the superstructure was not at risk as the cores of the piers had remained intact (YML/B3/3/1, 5).

Significantly, Smirke judged that the Great East Window, only recently restored, had ‘suffered very little injury’, and had perhaps only been affected by soot blackening (YML/B3/3/1, 5). The remaining Lady Chapel and choir windows appear to have sustained some damage, which may have included the glass, but Smirke was confident that these could easily be repaired. Smirke’s repair philosophy that the restoration should be undertaken with ‘materials of the same durable quality, as those employed in the original construction of the fabric’ and that the form of the new work should conform strictly to the design of the old ‘as far as it can be ascertained’ (YML/B3/3/1, 5-6). The drawings by Joseph Halfpenny (1795) were also to be used to inform the work, where the roof was to be restored in oak, or teak, and the ribs, webs, bosses and choir stalls also in oak. However, exactly how much Halfpenny’s work was used, or was of use, remains questionable. There is some evidence of dissent towards the new ornamental work, and a tendency, not only described in contemporary accounts but also reflected in the archaeology, for the workmen to expedite the restoration through the simplification of motifs. Writing in *The Builder*, James Wylson (1845) stated that:

‘whereas the old tabernacle-work, while rough in execution, was substantial and richly clustered: the new, though sharp and richly tooled, is slight and thin, and the finials at variance with it. Exception is also taken at the knots in the groining of the roof, which before presented an endless variety, but now exhibits a repetition of the same foliage’

(Wylson 1845, 158).

Smirke’s general estimate for the work amounted to £60,000, with the immediate recommendation that the building should be made secure and weatherproof. This involved the construction of the new roof and the rebuilding

of the parapets that connected with it, thus highlighting the potential for considerable intervention at the head of the east wall and clerestory. Those parts of the internal masonry which contributed to the stability of the structure, such as the piers, were also to be dealt with as swiftly as possible. The restoration was to be completed by 1831, with all other works to the fabric suspended (YML/B3/3/1, 7).

Just over a year after the fire, on 5th April 1830, Smirke submitted a report on the progress of the restoration works (YML/B3/3/4). The objective to stabilise and protect the fabric had been met, where the pillars of the choir had now been substantially repaired by the Minster masons. The clerestory walls had also been 'rebuilt', as had the cornice and battlements upon the walls, and the exterior screenwork on the south side. Since his first report in February 1829, Smirke appears to have undertaken a closer inspection of the clerestory windows, for they were found to be considerably more damaged than had first been recognised. The jamb mouldings of these windows were replaced, and Smirke discovered that a number had been 'repaired at a former period, apparently in consequence of some partial failure in the walls' (YML/B3/3/4, 1). These earlier repairs had consisted of the insertion of pieces of wood that were then plastered over, and may have been undertaken as a similar response to those that had been inserted in the nave clerestory, discussed above. Indeed, this brief, though important observation of Smirke's, is a further glimpse into the long and complex history of the structural problems of the eastern arm, and the Minster in general.

Hints about the working patterns of the masons also appear in Smirke's second report, where it is noted that the masons had spent the winter preparing the new ornamental features for the restoration, including the decorative capitals of the clustered pillars. The new choir altar-screen was also being prepared during the winter months (YML/B3/3/4, 1). The new roof had been fixed and leaded by November 1829, before 'the unfavourable weather began' (YML/B3/3/4, 2). The Minster was given a grant of teak by the government, delivered from Hull,

which was used instead of oak to reconstruct the main roof frame. Smirke felt compelled to justify this in his report, stating that without the grant the roof would not have been completed in time to protect the interior from the 'long and severe winter' (YML/B3/3/4, 2). The architect was also confident in the performance of teak over oak, being both strong and durable. At the time of writing, the ribbed frame of the vault, also in teak, was nearing completion, as were its moulded details in 'a light American wood' (YML/B3/3/4, 2).

The Restoration Fund accounts and vouchers (YML/B3/3/5; YML/B3/3/6) shed important light on the details of the choir restoration, including the materials used and the individuals who contributed to the work. Stone was again obtained from the Tadcaster quarries of Nicholas Drake and John Archbell, along with a further donation from the Thevesdale quarry on the land of Sir Edward Vavasour Bart. (YML/B3/3/6, 37). This was delivered by Snowden and Buckley, builders' merchants of North Street, York (Pigot and Co. 1829, 1139). It is these three sources that were used to rebuild the exterior parts of the eastern arm that were complete by the autumn of 1829, and were also used for the initial works to the interior.

Payments for Huddleston stone delivered by Messrs. Wilson and Bywater from 6th March 1830 represent the first reference to the renewed use of this quarry for the Minster in the nineteenth century (YML/B3/3/6, 116). Smaller quantities of Huddleston were obtained compared to those from the quarries of Drake, Archbell and Vavasour, and are therefore most likely to have been employed solely on the interior works. These operations are likely to have included the ornamental heads of the clustered capitals and the new altar screen, completed by John Scott by December 1831 (YML/B3/3/6, 323). No doubt Scott was running a substantial workshop, as he was paid for a considerable amount of carved work during the restoration, including fifty-eight capitals and thirty-two large projecting figures in December 1830 (YML/B3/3/6, 205). Importantly, these vouchers demonstrate the degree to

which the ornamental elements had been damaged and subsequently replaced in the choir and Lady Chapel.

That the clerestory windows and walls were considerably affected by the fire is also borne out by the accompanying works to the glass. The repairs to the stonework of the windows is likely to have been well advanced, if not completed, by the autumn of 1830, as by January 1831 John Barnett was paid £27/19s/11½d for stained glass (YML/B3/3/6, 210). Although not location-specific, Barnett's bill is detailed and itemises the production of figures and coats of arms, along with plain glass. A second bill paid in June 1831 is equally as detailed, with figured coloured glass, a head and a crown, pieces of garments, squares, lions and a fleur-de-lis border all present (YML/B3/3/6, 266½). Further plain coloured glass was supplied by the Southwick Glass works near Sunderland, and the Wearmouth Crown Glass Company (YML/B3/3/6, 218).

The final expenses for the restoration were paid in September 1838 and, in the main, encompass the completion of the interior woodwork and the building of the new organ. Although much of the stonework immediately affected by the fire had been dealt with by 1832 (i.e. the choir and Lady Chapel parapets, the clerestory windows and the arcade piers and their ornament), it appears that masonry work continued on the eastern arm. This may have been taking advantage of the scaffold originally built for the restoration. A later report by G E Street in October 1876 on the restoration of the south transept shows that linseed oil had been used as a protective coating on the choir masonry, a practice that was continue elsewhere on the Minster throughout the nineteenth century:

'acting on the experience gained by the new works done in the choir some years, I have had all the new work thoroughly oiled . This is unsightly at first, but the Choir shows us that in the course of time the stone recovers its colour and does not decay.'

(YML/B3/7)

The 1830s Fabric accounts include regular payments for oil, as well as purchases of 'rosin' and beeswax for waterproof cement (YML/E3/202V; YML/E3/205V). Old milk was also bought and was used for size and for cleaning the walls of the choir aisles (YML/E3/198V; YML/E3/200V). The thorough cleansing of the interior of the Minster to remove the traces of the fire was completed by the middle of 1835 (YML/Add.Ms 92/2, 231), by which time attention was once more returning to the condition of the East Front stonework.

From 1836 the south-east stair turret and spirelet was dismantled and rebuilt, but without the reinstatement of its ornamental parapet (YML/Add.Ms 93/2, 201). A large-scale drawing of the upper section of the turret and its spirelet (YML/3/10; Figure 37) indicates that this section of masonry was re-worked from the very top to the level of the main parapet of the aisle. The regularity of the setting-out and jointing of the stones suggests that it was substantially, if not totally, renewed. Whether or not the need to rebuild this turret was a consequence of the fire is unclear from the record, but perhaps its distance from the heart of the blaze is enough to suggest that it was not related to this incident. Indeed, Carr had remarked on the poor condition of the east end pinnacles in the 1770s, and so it is more likely that this work was a long-overdue response to those observations. With the use of stone from the revived Huddleston quarry still restricted to delicate works, purchases of Tadcaster stone from Drake and Archbell continued during the 1830s, along with orders for Roche Abbey stone from the famous quarry in South Yorkshire (YML/E3/201V; YML/E3/205V). A purchase of 168 feet of Roche Abbey stone was made in 1836-37, and it is therefore possible that this buff-cream magnesian limestone was used, at least in part, for the new south-east turret and spire.

3.5.4 The mid nineteenth century

Less than two years after the 1829 restoration account was closed, a second calamity struck the Minster. On 20th May 1840 a fire ripped through the nave of the cathedral, having been started accidentally by a clockmaker working in the

south-west tower (Chadwick 1977, 280). Although this incident is not directly connected with the eastern arm of the building, a number of features of the restoration process and the condition survey that emerged from it are. In general, the 1840s mark the increased use of Huddleston stone for renewals, and, significantly, mortar production. According to Wylson (1845, 159), calcined Huddleston offered a lime of superior quality and was introduced for the restoration of the western towers.

A *Report on the General State of the Fabric* (YML/B3/4/4) was made by the Architect Sydney Smirke during the post-fire restoration of the nave. This document was submitted to the Chapter on 30th March 1842 and included a new inspection of the east end. The report is a valuable landmark in the restoration history of York Minster as it provides a detailed overview of the condition of the building in the mid nineteenth century. It sheds light on the progress that had been made since John Carr's 1770 survey, and serves to clarify the areas that had, or had not, been altered during the time of William Shout and the post-1829 fire restoration. Furthermore, the report also demonstrates how even relatively recent work was already deteriorating rapidly.

Smirke divided his observations and recommendations into three distinct classes. The first class concerned areas which required urgent attention to ensure the safety of the building; the second were areas which had fallen into decay but were not yet in immediate danger; and the third were areas which would only require attention should the Dean and Chapter desire them to be aesthetically restored (YML/B3/4/4, 1). Within the first class of repairs, Smirke addressed the Lady Chapel parapet (therein described as part of the choir) and the aisle pinnacles. The second class covered nearly all of the portions of Minster, with each requiring some form of work. In respect to the choir, many parts of the exterior masonry were in need of significant attention. In particular, the clerestory screenwork was 'so decayed that portions of it must soon be in ruins' (YML/B3/4/4, 3), where a number of stones were close to falling on to

the aisle roof below. These observations were connected with the north clerestory. Smirke states that the corresponding sections of the south side of the Lady Chapel were substantially restored after the 1829 fire (YML/B3/4/4, 3). Again, it is possible to ascertain that the masonry had continued to deteriorate since Carr's survey. Areas of the stone work that had once required just cleaning and repointing, such as the north clerestory screenwork, now required extensive replacement.

Within the second class of works Smirke also expressed his concern over the increasingly poor performance of the magnesian limestone, which he believed not to be 'of a durable nature' (YML/B3/4/4, 3). As a response, he requested that all of the exterior masonry repairs that were to follow were to be undertaken in Huddleston stone 'in preference to Tadcaster which time has shown to be of very inferior quality' (YML/B3/4/4, 3). This reference is vital in informing the differentiation between both extant medieval work on the east end and phases of replacement, whilst also shedding light on the sequence of repair campaigns within the nineteenth century. Furthermore, it also demonstrates a clear shift in responsibility for the selection of materials from the masons to the architect. With Shout and Robert Smirke working exclusively with Tadcaster variants for their exterior works until c.1838, and Sydney Smirke requesting Huddleston from near Shirburn-in-Elmet for the post 1840 repairs, it is possible to identify the phases of repair works through petrographic examination of the stone. This is dealt with more fully in Chapters 4 and 5, which show that being able to identify each stone's provenance with greater precision helps to answer questions regarding rates of decay, the extent of previous intervention and the reasons for it.

The East Front also features within Smirke's third class of repairs. Here, Smirke noted that 'there are many evidences of decay in the exterior face' (YML/B3/4/4, 4), which is presumably a reference to the condition of the tiers of niches. The north buttress turret was also in a general state of decay, and Smirke suggested that it should be restored with new work 'as was formerly

done on the south side of the window' (YML/B3/4/4, 4). No doubt this was a reference to Shout's work of the 1820s, which saw the restoration of the south buttress' ornament and niches.

Smirke's final recommendation relating to the east front concerns the spire of the north east pinnacle, which was 'wholly wanting' (YML/B3/4/4, 4). Again, Smirke advised that it should be rebuilt with reference to its south-eastern counterpart, which had been rebuilt in 1836. In turn, this practice typifies the way in which the designs of restorations appear to propagate themselves across the façade. These restorations are likely to have differed in form and detail from their original, weathered predecessors from which they were copied, and in turn this begins to question the artistic integrity of the east front and the stylistic evidence which is so often used as the basis of understanding.

The final noteworthy aspect of Sydney Smirke's report are the statements relating to the western tower pinnacles. These again relate to the questionable quality of the stone sourced from Tadcaster. These pinnacles had been replaced by Shout relatively recently within the early 1800s, but by now were in 'a very bad state of repair' (YML/B3/4/4, 4). This brings Shout's ability to select stone into question, since the loss of these pinnacles in less than fifty years is alarming. While soft and suitable for rapid carving, as testified by the swift completion of Shout's work around the Minster, the stone types that he employed were not of a suitable quality to withstand the prevailing weather and increasing pollution at the west end. Smirke was also critical of the workmanship exhibited by these pinnacles, where he could not recommend their direct restoration as they were 'very incongruous in style and injurious to the effect of this beautiful façade;' (YML/B3/4/4, 4).

During 1844 evidence emerges to suggest that there were certain repairs required in the Lady Chapel that had remained outstanding after the main choir restoration. On 4th January of that year the Committee for the Restoration of York Minster resolved that the Lady Chapel should be prepared for the relaying

of the pavement. This had remained in its damaged state since the fire of 1829 (YML/B3/4/1). On the 15th January a further resolution was passed that the Clerk of Works was to commence with further 'sundry works' beneath the Great East Window. These works included a new string course under the niches and the repair of the canopies.

These works appear to have been designed to redress deficiencies in the east end interior, as the resolution called for the works 'to restore it [the Lady Chapel] to its original form' (YML/B3/4/1). This may be why the operations had been delayed, as they were not fundamental to its function or structural stability. A short run of detailed time sheets for 1840-1845 show that these localised repairs were put into effect from January 1844, along with the cleaning, colouring and 'washing over' of the ceiling in the Lady Chapel and choir (YML/B3/5/10). The 'cutting away and repairing of [the] old stonework under [the] Great East Window' was undertaken in preparation for the new carvings and mouldings, while work was also done on the easternmost arch of the north arcade over Archbishop Scrope's tomb. While it is possible that repair of this arch had escaped the restoration after the 1829 fire, it is also conceivable that these repairs were required as a result of some renewed movement of the structure. Cracks were also noted in the walls and stairs of the central tower at this time, which required pointing (YML/B3/5/9).

It is within the context of the 1829 fire and its aftermath that John Browne (1847) began his detailed study of the Minster. Browne's analysis of the documentary evidence for the building of the eastern arm has already been considered above, and so it leaves only his observations of the standing fabric to be considered here. Browne (1847, 277) was able to provide a valuable description of the choir and East Front, which sheds light on further changes that had taken place on the façade since Britton's work in 1819. Of the statues of Percy and Vavasour, only the latter still remained, with Browne remarking that that of Percy had been taken down around 1829. The reason for this action is not given, although it may have been removed for reasons of safety with a view

to replacement. Indeed, Britton (1819, 45) reported that the Percy figure was in a state of decay, and the progression of this deterioration may have rendered the statue unsalvageable. In any case, the fire and subsequent restoration intervened, and the figure was never reinstated. Though still in place, the statue of Vavasour was now seen as 'mutilated', and it appears that Browne (1847, 277) was merely repeating the description of Britton (1819, 45). A shield was still suspended to the left of the niche within which it stood.

Browne (1847, 277) also supplies a description of the head of the Great East Window, in particular the finial above the apex of the arch and the seated figure within the niche. Browne believed that the square turret of the finial had originally been finished with an ornamental cross, although it is unclear on what grounds this hypothesis was based. Browne was ambiguous with regard to the identity of the seated figure, but was certain that it represented an Archbishop:

'an Archbishop, pontifically robed, sits in a niche, holding a model of a church in his left hand, and giving benediction with his right.'

(Browne 1847, 277)

Browne's brief description is consistent with those of previous scholars; that the figure represented an Archbishop, and that the left hand held a church while the right was raised. Again like previous scholars, Browne does not describe the carved voussoirs within the intrados of the Great East Window. However, his clear description of the seventeen busts beneath the window suggests that they were in good condition at this time. This may have resulted from some form of repair or cleaning during Shout's tenure:

'Beneath the sill of the window is a series of seventeen busts, possessing much expressive character, and intended, no doubt, for Christ and the Apostles; also the Archbishop, the King, and two chief princes living at the time when the

representations were made. Christ occupies the centre, the archbishop the north end, and the King the south end of the series.'

(Browne 1847, 277)

Of Shout's 1820s restoration, Browne (1847, 319-320) openly criticised the work on the East Front, especially the Great East Window. Browne argued that the master mason had 'departed from his accustomed attention and accuracy' by removing the sculpted leaves from the existing transoms to avoid reinstating them in the new work. Significantly, Browne himself appealed to the Dean and for their reinstatement, and so the leaves were duly made and cut into the masonry of the lower part of the window. Unfortunately, by this time the scaffold had already been removed from the head of the window, and so this area remained bereft of three hundred and sixty ornaments. A drawing produced sometime after Shout's restoration shows the ornaments pencilled-in across the tracery, perhaps implying that there had been an intention to reinstate the foliage across the entire window at some stage (YML/3/17; Figure 38). Notwithstanding funding, it is arguable that Shout had become less conscientious in his aim to sustain the design of the East Front. If so, this may well have transcended to the other decorative elements of the façade, such as the niche-heads and their pedestals. This could have resulted in their simplification in favour of expediency.

While the 1840s involved ongoing repairs to the interior of the eastern arm, further substantial re-building works were undertaken on the East Front exterior in response to Sydney Smirke's survey of 1842. Setting-out drawings and contemporary commentaries shed much light on these works, which in sum involved the replacement of the main parapets above the east windows of the north and south aisles, the entire renewal of the north-east turret, and the restoration of the north buttress adjacent to the Great East Window. Being works of the 1840s, they were all executed in Huddleston stone and were the last areas to be repaired before the final nineteenth century repair phase that began in the 1890s.

The first stage of this campaign was to restore the gablets of the south aisle parapet, and a scaffold was erected for this purpose in May 1847 (YML/Add.Ms 91, 33). Since Shout had previously replaced this parapet in the 1820s, it is again alarming that his work required renewal only twenty years or so later. The likely extent of the parapet renewal is shown in YML/3/22 (Figure 39), being an elevation, part-plan and section produced in 1847. All four gablets are shown, along with the weatherings down to the main stringcourse above the aisle window. Following the completion of these renewals, a localised scaffold was erected against the north buttress of the East Window in July 1848 in anticipation of its restoration (YML/Add. Ms. 91, 65). Two unlabelled large-scale drawings of the upper part of the north buttress survive (YML/3/11 & YML/3/12; Figures 40 and 41), and may therefore pertain to this phase of work. Without annotation, the drawings are of little use as means to understand the detail of work, but give an idea of the extent to which the buttress was being examined. Indeed, Smirke's recommendation that the whole should be restored is enough to suggest that the buttress was to be substantially re-worked. At the same time, it appears that some attention was paid to the repair of the clerestory screenwork on the north side, having been an item in Smirke's second class of repairs in the report of 1842 (YML/B3/4/4, 3; YML/31/49; Figure 42).

By July 1850 the restoration of the north buttress had been completed and the scaffold removed. At the same time a new scaffold was being erected at the north-eastern angle to restore the gablet parapet and corner turret (YML/Add. Ms. 91, 65). Drawings of this section of the façade were duly prepared (YML/3/7 & YML/3/14; Figures 43 and 44) and yield similar information to the previous examples given above. The seven parapet gablets were renewed (a further premature replacement of work by Shout), along with sections of the blind arcading below. The north-east turret was to be rebuilt anew, with the plan of this turret also illustrating the distorted alignment of the wall between the turret and the east-window buttress (YML/3/7; Figure 43). Supporting pictorial evidence in the form of one of the earliest known photographs of the

East Front (Figure 45) shows that the turret was entirely taken down before rebuilding. The Hornby scrapbook (YML/Add.Ms.91) also records the unrealised intention to restore the full-length figure of Vavasour in the northernmost niche.

The completion of the works on the north side of the East Front saw the end of a restoration campaign that had begun with William Shout in the 1820s. Although the masons would not return to the façade to undertake any stone repairs for some fifty years, two important interventions during the second half of the nineteenth century are still to be noted. The first was the installation of patent stoves in the aisles of the eastern arm of the Minster in 1861 (YML/E4e; YML/Add. Ms. 92/2, 231). The large flues of these stoves cut through the aisle wall to an exit through the aisle roofs, and provided a regular and immediate source of sulphur dioxide. That the stonework of the east end was subjected to this sustained, close-contact with coal smoke would have no doubt contributed to the failure of the stone over time. Indeed, the consequences of the presence of these stoves may still be manifesting themselves today.

The second and final intervention to briefly note is the installation of the protective glazing of the Great East Window. This was implemented during the time of Dean Duncombe between 1861 and 1862 (YML/Add. Ms. 91, 66; French 2003, 13). An original drawing of the scheme for the protection of the glass is shown in YML/3/40 (Figure 46). The new glazing, secured with 'keys', can be seen to occupy what had previously been the groove for the stained glass. In turn, a fresh groove was created further back within the window masonry inside which the stained glass was re-set. The result can be seen from afar in a photograph of the East Front taken by Francis Frith in 1871 (Figure 47), which also usefully shows the extent of pollution related soiling on the façade at this time. Here, the sheltered zones of the elevation are especially black, and this includes the recesses of the relatively new work of the 1840s and 1850s on the north side.

To conclude, it can be seen that the nineteenth century represents an extremely important chapter in the repair history of the East Front, and Minster in general. The increased quantitative and qualitative survival of archival evidence for this period enables a detailed and complex understanding of the reasons why and how the many interventions took place upon the façade. The seeds of these restorations had been sown in the late eighteenth century. The survey of John Carr and the arrival of William Shout represent key moments in the response to the deterioration of the Minster's stonework through the effects of time, and, increasingly, decay related to atmospheric pollution. However, the need to restore and repair parts of the building was not new, having been ongoing, albeit on a smaller scale, during the preceding centuries. Rather than being a product of artistic over-enthusiasm, which had been drastically transforming buildings such as the cathedrals of St Albans and Canterbury (Fawcett 1976, 74, 99), the 'restorations' at York Minster had been following the much soberer agenda of structural stability and the *maintenance* of the design. The only exception to this was Street's restoration of the South Transept in the 1870s, which sought to reverse Shout's eighteenth-century re-working of the façade to a new Early English design. In any case, the exhaustive approach to the repair of the fabric had left few areas untouched by nineteenth century hands. Doubtless this period represents the time when most of the primary exterior of the Minster was lost, not least because of the two major fires which may have led to more renewal of the fabric than would have otherwise been necessary. The demands of the repair and restoration programmes had, unfortunately, led to expediency, with the choice of stone and the attention to detail seemingly compromised in favour of getting the job done.

Perhaps the most significant aspect to draw from this period is how the repair of the building was not just centred upon stone replacement. On the contrary, the work of the masons routinely extended beyond this. Thought was given to the protection of new and existing stone in the form of protective coatings such as linseed oil, stale milk and lime, and the building was regularly cleaned both inside and out. Scaffold systems were usually more localised, and avoided

obscuring large expanses of the Minster for long periods of time. In all, the masons appear to have been versed in techniques which might now be attributed to the toolkit of the practical stone conservator, and it is altogether enlightening that attention was paid to retaining stone as much as replacing it long before the emergence of the Society for the Protection of Ancient Buildings (SPAB) in 1877. While it is arguable that expedience rather than conservatism was the motive behind such methods of repair prior to c.1900, the underlying practical aim to *prolong* the life of the stonework has continually remained the same.

As the nineteenth century came to a close, the workforce returned to the East Front to begin the next cycle of repair upon the parapets. It is this phase of work that forms the starting point of section **3.6**.

3:6 Decline and Revival – the twentieth century

3.6.1: Overview

Despite regular, and in some cases major works to the Minster fabric during the second half of the nineteenth century, by the 1890s the rate of the decay of the magnesian limestone was seemingly overtaking the rate at which it could be replaced. On 2nd February 1899 Dean Purey-Cust launched an appeal for £50,000 for 'The Restoration of York Minster' (Purey-Cust 1899a; Chadwick 1977, 310). This campaign was orchestrated through a sequence of appeal booklets compiled by the Dean in collaboration with the architect, G F Bodley ARA. The restoration work was specified by Bodley, and marked the beginning of a long programme of repair which extended well into the twentieth century. These alterations also saw a major shift in the materials used under the direction of the architect, where New Ketton oolitic limestone from Lincolnshire was substituted for magnesian limestone. Bodley believed that the New Ketton would be more resilient to the increased sulphurous attack, then being experienced as a result of the development of the nearby railway depot (Curry

1997, 51). It has to be said that the use of magnesian limestone at York Minster had already been dying a slow death. By 1872 Huddleston stone had fallen out of favour, perhaps because there had been difficulty in gaining appropriate amounts of quality stone. Indeed, a memo from the quarryman, George Marsden in 1876 canvassed the Minster to renew its interest, stating that they were 'among some good stone at present' (YML/E3/241V). However, Street opted for a return to the quarries of Tadcaster and Bramham for the restoration of the South Transept, this being the last major operation on the fabric in the nineteenth century.

The archive that accompanies this sequence of intervention is especially rich in information, particularly because of the survival of the Detailed Time Accounts from 1895 onwards (YML/Acc.1967/11; YML/Acc.1974/7). Week-by-week, the Detailed Time Accounts record the individuals associated with repair and renovation, along with the hours spent on certain tasks and the methods and materials used. As a result, a unique insight into the precise identity and activity of the workforce can be gathered, building a detailed picture of their progression around the building. These accounts form the basis of the data for the twentieth century, as by now the fabric account books had become much simplified, with their use confined mainly to references for sources of materials.

The Detailed Time Accounts also facilitate the understanding of the twentieth century restorations on a micro-level, whilst also enabling the assembly of a long-term perspective on the repairs and the way in which the works department operated over time. The impact of two World Wars can be followed, with the second having the most prolonged influence on the way in which the building was, or was not, maintained. Changes in materials for repair, catalysed by post-war regeneration in the 1950s alongside a decline in able craftsmen, was to add to the Minster's problems. Hence, by the late 1960s the Minster's structural condition was deemed critical, and the greatest works of modern intervention at any English cathedral were undertaken under the direction of the late Sir Bernard Feilden (1976).

3.6.2 1895-c.1956

Dean Purey-Cust's 1899 appeal booklet presents the works that had recently taken place on the nave roof, eastern arm and central tower, along with a printed version of Bodley's basic specification and estimate for the new repair programme that was set to last fifteen years (Purey-Cust 1899a, 19-20, 27-28). This plan was to involve the restoration of the parapet and pinnacles of the eastern and western façades, the nave, the choir and the central tower. Furthermore, Bodley also requested that the flying buttresses of the nave should also be reinstated.[2]

In the choir and Lady Chapel, only works to the St. Cuthbert and St. William windows are mentioned by Purey-Cust (1899a, 19-20). However, contemporary photographs within the same publication along with the Detailed Time Accounts suggest that a more extensive repair process had been underway on the windows of the eastern arm. The photograph on p20 shows that the westernmost south-aisle window of the Lady Chapel received attention from a localised scaffold in 1887, while the Detailed Time Accounts (YML/Acc.1967/11/v1[*]) show that works had been ongoing within the interior of the chapel, as well as upon the exterior. The workforce comprised a carver, four masons, a joiner, a bricklayer and six labourers (YML/Acc.1967/11/v1). The use of timber scaffolding was still current, and relied upon the cutting or re-using of putlog holes into the existing masonry to anchor it to the wall. Often, the scaffold was erected once the stone was cut and ready to be fixed, suggesting that measurements for replacements were usually taken earlier, perhaps from a ladder or bosun's chair. Once the repairs were complete, the scaffold was struck and the putlog holes were filled in again. This is significant, because it indicates that medieval approaches to scaffolding were still in use in

[2] The toothings of the buttress flyers had been created during the medieval construction, but were never used. However, they were cited by Bodley as evidence that flyers had once existed and the buttresses were fully restored.

[*] 'v' denotes Volume Number and has been added by the author

the late nineteenth century. Moreover, it means the putlog systems observed archaeologically may be of multiple periods. Consequentially, any attempt at a reconstruction of an original scaffold system as a means of understanding a construction sequence must be aware of the potential for this 'contamination' and re-use from other periods of work.

From 11th December 1897 the accounts provide a detailed outline of the first works of Bodley's tenure on the East Front, which, on completion, were reported on by Purey-Cust (1899a, 20, 25; 1899b, 4; 1900, 3). This project involved the replacement of Shout's work to the central pinnacle and finial above the Great East Window, along with the parapet and pinnacles of the north central buttress turret. This highlights the cyclical vulnerability of work at high-level, although it is somewhat fortunate that this area of Shout's work had lasted longer than the other East Front parapets which he had worked upon. After the production of drawings of the central finial from the East Front parapet, the masons began preparing the scaffold from which the works were to be executed. By September, the 'flying' scaffold was complete, as shown in Figure 48.

Bodley's annotated survey of the pre-existing parapet, shown in drawing YML/3/38 (Figure 49), offers some useful insights into the history of the parapet and the changes that had taken place before the 1890s. The coping and parapet arcade on the western side was found to be a replacement after the fire of 1829, which shows that the summit of the East Front had indeed required some form of restoration at this time. Bodley's annotations, along with a photograph of the parapet taken prior to work (Figure 50), show that elements of the central pinnacle had since been lost, particularly as there was no longer any complete evidence for the cresting detail of the pinnacle. Furthermore, it is possible that certain features of the pinnacle had been simplified during the earlier restoration, as Bodley believed that the surrounding niches had originally contained more substantial 'corbels' or pedestals, perhaps intended to carry statuary. The architect further requested that the cuspings of the niches

should not be cut too thinly, perhaps to increase their resistance to weathering and decay. In sum, it would seem that much of the detailing of the parapet had to be reconstructed from educated guess-work, and that the design had undergone a number of changes over time, both through deterioration and restoration.

The strategic use of the flying scaffold from the East Front parapet to undertake these works enabled the masons to gain access to the defective masonry with relative ease. Moreover, the scaffold shown in Figure 48 may reflect that of a similar form used by the masons who had originally built the summit of the eastern façade, where the decorative piercings of the parapet doubled-up as putlog holes. Thus, this pragmatic use of the flying scaffold in the late nineteenth century may also be indicative of a continuity of both construction and repair traditions throughout the historic period. Once the scaffold was complete, the ornamental parapets of the north and south pinnacles were accessed and measured. The remainder of the autumn and winter of 1898-1899 was spent sawing and cutting these features for the north-east pinnacle and decorative work was executed by the locally-celebrated carver, Sam Monk. From the 3rd February 1899 the main parapet of the East Front began to be dismantled, with the stone for this section then immediately underway.

By Easter 1899, Purey-Cust (1899b, 4, 9) reported on the progress of renovation. With the potential for criticism in Purey-Cust's mind, the works were described as 'the careful and conservative restoration of the pinnacles, the parapet, the arcading, and the beautiful central finial with its massive supporting block of stone' (Purey-Cust 1899b, 9). The project also sought to restore 'the figure of Thoresby at the summit of the window, and the fifteen [sic] heads beneath'. Of the seventeen heads, those that were in a satisfactory condition would remain 'untouched', while those that were severely decayed were to be renewed.

Unsurprisingly, however, Purey-Cust's cautious vocabulary was unsuccessful at keeping the SPAB at bay. Soon after the publication of the Dean's Easter Report (Purey-Cust 1899b), a letter noting the intention to restore the East Front statuary was sent to Bodley by Thackray Turner, then SPAB Secretary (SPAB/Box138/YorkMinsterI). The architect was asked to express his views upon medieval statue restoration, which, according to the SPAB, was a practice that had long since been 'condemned and abandoned' by others, including the British Museum. A reply from Bodley does not survive and it would appear, at least for the time being, that the wishes of the architect and the Dean and Chapter were quelled by the SPAB's enquiry. This is implied by the fact that there are no corresponding entries in the relevant years of the Detailed Time Accounts to suggest that any work on the seated figure or busts had taken place.

By September 1899, the central pinnacle of the East Front was being dismantled, while the new parapet stones to the north central pinnacle were being fixed. The exact composition of the mortar used for this is unclear from the archive, although labourers are regularly recorded for 'riddling', or sieving, lime, suggesting that quicklime was still in use and was being refined to remove its air-slaked, or un-slaked, constituents to ensure a smoother mix. Waste stone was also being broken during the mortar-making process, implying that stone dust, in this case New Ketton oolites, was being used as an aggregate. Furthermore, the presence of quicklime-working at the Yard is also prevalent in the entries relating to lime putty production, which was manufactured for the plaster-work that was undertaken by the Minster workforce. Indeed, the yard was not simply occupied with work at the cathedral, but was also actively engaged in the repair of the buildings of the Minster Close and Petergate.

Having gradually trickled into use from the early nineteenth century, the use of cements had also become part of the repair repertoire at this stage. Being less compatible with the fabric, such materials would have introduced another threat to the durability of the stonework at a time when it was most vulnerable to decay. Throughout the autumn and winter of 1899 the masons continued to

work on the East Front. Both carving and fixing took place, including the erection of the new central pinnacle (YML/Acc.1967/11/v1-2). The fact that the masons were fixing during the winter marks a significant departure from previous working practices, where the behaviour and workability of lime had originally dictated the number of months that could be spent on actual construction. Now, more could be achieved in a shorter space of time under adverse weather conditions.

By April 1900 the scaffold began to be dismantled and the parapet cleaned down, and by the summer the work was complete. Purey-Cust's interim report praised the work, placing much emphasis on the success and desirability of a project that had restored the East Front 'to its original beauty' (Purey-Cust 1900, 3). A similar report for the following year offers some important glimpses into the new work that had been completed on the East Front, and also the contemporary understanding of the problems of pollution (Purey-Cust 1901). The photographs given on pp9 and 11 of the report show the renewed parapet of the north central turret and the central parapet and pinnacle (Figures 51 and 52). In the former, the photograph indicates that the works had focused only on the ornamental cresting, with adjacent stonework on the southern side seemingly unaltered. Significantly, the projecting arrises of the work appear much whiter than the sheltered areas suggesting that the dry deposition of sulphur dioxide was both rapid and ongoing, having blackened the stone in only a year. This also appears to the case in the second photograph, which conveys a darkening of the sheltered areas of the stone.

In respect to the pollution problem, Purey-Cust (1901, 4) states that the contrast between old and new work, seen as a defect, would soon be 'remedied by the dense smoke which seems to be more and more enshrouding the good city of York'. Indeed, the fact that coal smoke and its effect on stone had become such a problem appears to have had a direct role in altering its architectural detailing. New Ketton stone had been selected for use in the belief that it would have been more resilient to decay. This had an immediate impact on the

appearance of the building. The stone did not tone in with the existing work, not only because it was new, but also because it was of a differing geology to the existing masonry. The granular, oolitic matrix of the New Ketton also meant that it was less receptive to fine chiselling, with the replacement carved elements appearing, bulky, simplified and shallow. This can be seen in Figure 53. However, the creation of simpler forms mitigated the action of the sheltered decay mechanism, as there were fewer deeply-cut facets in which the gypsum could readily accumulate.

The Minster workforce continued to react to the effects of the pollution elsewhere on the cathedral during the first years of the twentieth century, and turned their attention to the west end of the building, beginning with the North West Tower. Through 1902 significant amounts of moulded and ornamental stone were replaced at high level, although Purey-Cust (1902, 6-11) was keen to emphasise that the existing figures on that part of the building had not been touched. When compared to the earlier proposals for the East Front statuary, the Minster now seemed staunchly aligned with the philosophy of the SPAB in the way that it sought to justify its conservatism:

'Some of them [the figures], though indistinct, have a grace and beauty of their own, resulting perhaps very much from the rain and frost which have varied their surfaces with more graceful channels and features than could have been imparted to the by the chisels of those by whom they were 'rough-hewn' and who have been dead and buried long ago. And some of the figures are so decayed that it is difficult to decide whom they were intended to represent… It is better policy, perhaps, on the whole, to leave such fragments undisturbed, than to endeavour to supply details which might prove out of harmony with them and by their pretentious novelty efface the dignity and grace of the old.'

Purey-Cust (1902, 6, 11)

Purey-Cust (1903, 27; 1904, 6) stated that the current repair and restoration work was focused on the replacement of stone used by William Shout during

the west front restoration just seventy years before. Again, this raises questions regarding Shout's stone selection in the early nineteenth century. There was also some serious criticism as to the accuracy of the ornamental work of Shout's team, which, although carefully done, 'lacked the spirit and tone of the Mediaeval craftsmen' (Purey-Cust 1906, 6). Additionally, there were doubts regarding the success of Shout's work in maintaining the structural integrity of the façade, where 'the bonding of the stones had been so carelessly and imperfectly carried out, that many had fallen, many were insecure, and nothing short of the thorough restoration of the whole… would be sufficient for the safety and beauty of the building (Purey-Cust 1906, 6). These comments relate directly to Shout's work on the west end of the building, although this does raise the possibility that his subsequent restoration of the East Front had been executed in a similar manner, i.e. with inappropriate stone, inaccurate ornamentation and inadequate construction.

Despite the fact that the main focus of the early twentieth-century work was directed towards the exterior west end of the building, a number of benefactions to the Minster led to some decorative alterations to the Lady Chapel interior from 1902 onwards (YML/Acc.1967/11/v2). This involved the introduction of four new statues of Archbishop Thoresby, William of Wykeham, Lord Henry Percy and Bishop Walter Skirlaw (Purey-Cust 1903, 6). These figures were introduced to the inner faces of the main piers of the Lady Chapel and necessitated the insertion of new pedestals, and a canopy above the image of Thorseby. The statues themselves were produced by Messrs. Farmer and Brindley, but the pedestal work remained at the Minster's yard and the stone was specially selected at Huddleston quarry by the foreman mason. Whether or not any existing pedestal and canopy work had been removed in the insertion of the figures is at present unclear, although it is possible that some fire-damaged remnants had remained until 1903.

The interior alterations made to the Lady Chapel at this time also included the restoration of the Lady Chapel Reredos in Memory of the late Queen Victoria,

and plans to restore the head of the Bowett Tomb that had been damaged in the 1829 fire (Purey-Cust 1903, 11; 1904, 5). In particular, the work to the reredos is important, since it may have involved a certain amount of intervention to the base of the interior screenwork of the Great East Window. The figures were designed by Bodley, executed by Lawrence Turner and fixed by the Minster masons in September 1905 (YML/Acc.1967/11/v2; Purey-Cust 1906, 27). Annually, time was spent dusting and cleaning the interior of the Minster, including the sweeping out of the east end galleries, roofs and turrets, and the regular washing of the Lady Chapel monuments and floor (YML/Acc.1967/11/v4).

From 1902, further stone treatments were also used by the masons to protect the stone and mitigate the contrast between the New Ketton and the existing magnesian limestone. In July 1902 a number of hours were spent darkening, preserving and painting stone (YML/Acc.1967/11/v2). Later on, in 1906, labourers were also involved in protecting the stone on the west end by the application of linseed oil, whilst damaged elements were also pinned by the masons. These valuable references show that the use of linseed oil as a stone treatment had now been ongoing for over a hundred years at the Minster, and its application was set to continue.

By 1909 the Minster appears to have become a haunt for representatives of the SPAB. Regular observations were made regarding the condition of the stonework and the way in which it was being repaired. In November 1908 for example, the SPAB commented on the replacement of the mullions and tracery of the nave clerestory windows, despite the fact that they appeared 'quite sound and only slightly decayed on the surface' and could have been made good by re-facing only, as had since become customary elsewhere (SPAB/Box138/YorkMinsterI). Similarly, during the same phase of repairs to the nave in December 1909, the stonework of the windows was being unnecessarily replaced and could have instead been carefully repaired. Significantly, the SPAB representative went on to recommended that the

decayed surface of the stone could be treated with lime and baryta water. This treatment was also advised for the stonework surrounding the windows 'in order to arrest the decay and harden the surface of the stone' (SPAB/Box138/YorkMinsterI).

In September 1914 the works department returned to the East Front, having recently completed the total 'restoration' of the flying buttresses to the nave, the central tower parapet, and the construction of the new Stoneyard in Deangate (YML/Acc.1967/11/v4-v6). The works department appear to have deemed it necessary to revisit the façade to tend to the protective glazing and stonework of the Great East Window. The reasons given for this intervention were the same as those given in 1906 for work to the North Transept's 'Five Sisters' glazing. Here, the iron stanchions which carried the protective glazing had rust-jacked, breaking the glass and cracking the stonework (Purey-Cust 1907, 21). However, the scheme may also have been devised to keep the workforce in employment. Indeed, this has been cited as one of the reasons for the addition of the flying buttresses to the nave (Chadwick 1977, 310 fn100).

The project began with the labourers preparing and fixing the scaffold to the East Window and north and south-east buttress turrets between September 18th and November 6th 1914 (YML/Acc.1967/11/v6). As the scaffolding progressed, the masons immediately set to work from the lower stages by taking sections, mouldings and elevations from the north-east buttress, while also beginning to cut out the stones that were to be replaced (YML/Acc.1967/11/v6). As in previous work, details to the new masonry, including buds and crockets, were added by Monk the carver. Some new elements were also pieced into the niches and mouldings of both the north and south-east buttresses and the arcading above the north Lady-Chapel aisle window. In addition, work also began on renewing the main gablets upon the north aisle parapet. As with the campaigns immediately preceding these works, Ketton stone from Molesworth Quarry was employed.

Whilst replacement of stone on the north-east side continued, measurements for glass templates were taken for the new protective glazing of the Great East Window. Work also began on the carved heads beneath the sill of the window, whereby the heads were numbered from 1 to 17 south to north, and sizes and moulds were taken. A set of photographs of the carvings were taken prior to the commencement of work and show the heads dark with surface soiling and in varying states of preservation (Figures 54-62). These images illustrate that in some cases the level of detail was still incredibly high, while in others features had been entirely lost. Moreover, the appearance and style of several the carvings (e.g. nos. 6 and 15) suggests that a previous programme of renewal had perhaps taken place.

Monk began by carving the first new head (No. 3) on the 26th November, and by June 3rd 1915 the frieze had been restored. Twelve of the heads and been altered in total, whereby Nos. 3, 5, 7, 9, 10, 12 and 13 had been replaced and Nos. 6 and 8 piece-repaired. Furthermore, heads 4, 11 and 14 had been given new foil panelling to the head surround. Though principally produced by the carver, the masons were also responsible for some finishing work to the heads, much of which may have taken place from the scaffold once the stones were fixed. Duties were not confined to replacement work either, since the regular cleaning, linseed-oiling and re-pointing of the East Front was also underway by the end of 1914. This encompassed the stonework above the East Window, as well as both of the buttresses, and, according to the Detailed Time Accounts, this was executed using cement (YML/Acc.1967/11/v6). The composition of the cement is indefinable from the accounts, although the fact that lime was still being prepared in the yard suggests that the mix may have been a hybrid of lime, cement sand and stone dust.

Though the priority was to replace the protective glazing of the Great East Window, certain parts of its stonework were also renewed. This has been completely overlooked by previous scholars and so a careful consideration of the alterations is necessary. At the end of December 1914 templates were cut

for the tracery of the window, although it is unclear whether this was to the replacement of the protective glass for the tracery at the head of the window, the stonework of the same, or the decorative transom below.

Into 1915 work progressed on the highest stages of the north-east buttress, which included revisiting and adding to the earlier restoration of its ornamental parapet. Whether or not parts of the previous work had failed is unclear, but the addition of new replacement stones here may suggest that the masons were now able to reach parts of the buttress that had been inaccessible from the flying scaffold. Furthermore, the programme progressed to the replacement of the decorative parapet and grotesques of the north-east turret, beginning with the buds and finials. Work also continued on the stonework of the East Window, initially on the 6th stage of the scaffold, and then on the 4th stage at the level of the first transom (YML/Acc.1967/11/v6). On the 4th stage, the repairs involved the working of pieced mullions and tracery, suggesting that portions of the stonework were being renewed back to the glass line. By March, the old protective glass began to be removed from the East Window, and, at the same time, further sections of the mullions and transom were marked-up for cutting out. As the removal of the glass continued, new grooves and bar holes were cut into the masonry to receive the new protective glass (which was to be set further forward to the existing), and the tracery and adjacent stonework at the head of the window was cleaned, oiled and re-pointed between stages 2 and 10. As the new protective glass was inserted upon painted iron bars, the interface between the glazing and the stonework was also pointed with putty and cement. Stone was also worked on the 3rd stage, in the vicinity of the window's jambs and its connection with the north-east buttress.

In August 1915, a notable alteration was made to the keystone at the apex of the East Window, at stage 10. To begin with, a new stone was worked and fixed by the masons. Following this, the form of the 'grotesque head' was carved by Monk *in situ,* taking sixteen hours to complete (YML/Acc.1967/11/v6). That the carved element of the stone was completed *in situ* is implied by the fact that the

entries relating to the masoning and fixing of this single stone precede that which records its completion. This sheds important light on the issue of when it was deemed appropriate to carve the stone, *in situ* from the scaffold, once the stone was in position. In so doing, the masons were not held up by the carvers. Moreover, given that the stone was being transported to a high level on the building, there was less risk of the ornamental work being damaged in transit. It would also have been easier to marry the new work with the old once it was fixed alongside it.

By October, as the fixing of the new protective glazing was completed, the scaffolding began to be removed from the summit of the East Window and north-east buttress. The process was finally completed in March 1916 (YML/Acc.1967/11/v7). As the scaffold was dismantled, work continued on the lower stages with the oiling and cleaning of the stonework, along with the painting of the outer glazing bars, presumably to protect them from rust. These finishing works were timed with a visit by F W Troupe FRIBA on 28th October, who reported back to the SPAB on the 1st November 1915 (SPAB/Box138/YorkMinsterI).

Although Troupe was concerned mainly with the general works to the Minster's glass, his report sheds important light on the works that had been proceeding on the East Front. Firstly, he noted that nothing had been done to the original glass panels of the East Window, other than to protect them with plain diamond glazing. A report on the works to the Minster glass during the World Wars by Harrison (1943, 22) also testifies to this effect. Secondly, some significant remarks are made regarding the treatment of the stonework. Accompanied by the architect Walter Tapper, Troupe was informed that the new carved heads below the sill of the East Window were reproductions of those that had disappeared. Although this was not in accordance with the current thinking of the SPAB, Tapper had felt justified in making these changes as the masons believed they were only replacing eighteenth century work that was

presumably considered to be of less value. Troupe appears to have been in agreement with this, for of one of the earlier heads he remarks:

'One in particular but for its own history might have been fourteenth century: the stone from which it was carved however was alone conclusive evidence of its date.'

(SPAB/Box138/YorkMinsterI)

With the form of the historic heads shown in Figures 56 and 61 in mind, this observation is important in the history of the façade and may indeed mean that the heads were previously restored. This may have well been in the eighteenth century when the 'bottom basement' of the East Front was repaired under the direction of John Carr. Furthermore, Troupe was informed that 'the whole of the East End appeared to have been refaced in [the] 19th century (including the East Window) some of it twice over' (SPAB/Box138/YorkMinsterI). This is a further testament to the cyclical vulnerability and remedial action upon certain areas of the façade, not least because of the increasingly destructive atmosphere of York and because of the round of replacement under William Shout had been expediently undertaken with inappropriate stone. A final significant aspect of Troupe's report is that Tapper agreed to try the ''Siasic' treatment' on parts of the stonework that were damaged but were to remain *in situ*. This treatment was developed in the early twentieth century and marketed as 'Hemingway's Siastic [sic] Solutions' (Twelvetrees 1915, 108). The process involved the application of silicate of soda to clean dry stone followed by arsenic acid. Believed to be the most effective preservative of limestone at the time, it was later found to be prone to failure through cased-hardening the stone to leave friable surfaces beneath (Department of Scientific and Industrial Research 1927, 30).

As the Great War took its toll, members of the workforce either entered active service or were simply laid off, and by the summer of 1916 there were only four masons, one carver, two joiners, a bricklayer and four labourers employed at

the yard (YML/Acc.1967/11/v7). As a consequence, the work to the north-east turret and gablet parapet over the north aisle of the Lady Chapel slowed down, a situation exacerbated by the decision to remove almost all of the Minster's stained glass for safety to a strong room in the Deanery Garden, whereby it would be temporarily replaced with plain panels. The scaffolding of the Minster windows for glass removal also drew the masons' attention towards the condition of the associated stonework, and in November 1916 scaffolding was erected against the north-east window of the East Front, at the termination of the Lady Chapel's north aisle. Here, the glass was removed to the Deanery strong room, and sections of the mullions and tracery were grooved or cut out and replaced as the scaffold was added (YML/Acc.1967/11/v7). Some of the stone for the work was prepared at York Station's Goods Yard, where it was sawn by the masons and then conveyed to the Minster. The work was executed rapidly, and by January 1917 the scaffold was removed and transferred to undertake similar works on the corresponding window to the south of the façade. However, in this case the window was only cleaned, re-grooved and barred for the protective glazing without any stone replacement. From here, the masons continued in a similar fashion with the aisle and clerestory windows of the eastern arm, whilst also continuing with the works to the north-east turret and gabled parapet over the termination of the north Lady Chapel aisle.

During 1918, effort was also directed towards the reorganisation of the Lady Chapel interior. This work was created as it did not demand the presence of a substantial workforce (YML/Acc.1967/11/v8). By August 1918 the team had fallen to just two masons, one joiner, one bricklayer and four labourers. By April 1919 the number of workmen had begun to recover, and so work resumed on the north east turret and parapet gablets of the East Front into 1921, while works to the interior, discussed below, continued. It was during October 1920 that the switch from using Ketton to Clipsham stone was made for masonry renewals (YML/Acc.1967/11/v9/Fo97). No doubt this was due to the fact that the Ketton replacements were already beginning to show signs of decay and deterioration owing to their contact with run-off from the magnesian limestone,

a known cause of failure, and the continuing problems of pollution (Brooke 1976, 79). Clipsham, being a shelly oolitic limestone from Rutland, was known to weather well and was therefore considered suitable for high-level work. Its toughness, however, meant that it was less easy to mason and carve, and so the detailing and opportunity for creativity suffered as a result. Clipsham was used for the concluding works to the eastern arm during the early twentieth-century cycle, which finished with the entire renewal of the parapet and pinnacles above clerestory level from 1931 (YML/Acc.1967/11/v10).

By June 1921 the upper section of the scaffold on the turret and parapet began to be dismantled. Works continued below, with the cutting-out and replacement of the arcade heads, and mouldings below the parapet and turret crest, along with sections of the masonry below the string course on the 4th stage of the scaffold (YML/Acc.1967/11/v9/Fo101[3]). As this scaffold was gradually removed from the east front, the final works on the west face of the north east turret were completed from the level of the aisle roof. These repairs were finished by June 1922 (YML/Acc.1967/11/v9/Fo303). From 1923 to 1927, work was undertaken on the clerestory windows of the Lady Chapel and western choir, whereby scaffolds were systematically erected from the summit of the aisle roofs (YML/Acc.1967/11/v9). The mullions, tracery and capitals were renewed back to the glass plane, and, in the case of the Lady Chapel windows, several of the carved transoms between the inner window and the outer screen work were replaced. Again, the stonework was cleaned and oiled in an effort to protect it from decay.

The interior works to the Lady Chapel that took place from 1918 involved the re-siting of a number of memorials in and around the east end, along with repairs, cleaning and new additions to the fabric. The first monuments to be re-fixed were the Tombs of Archbishops Rotherham and Markham, and in August

[3] The format of the Detailed Time Accounts changes for Volumes 9 and 10, whereby Folio Numbers are provided. The accounts are also organised by operation, e.g. restoration or general maintenance, rather than date.

1927 the Romanesque Virgin and Child statue was cut out from its niche on the north of the Lady Chapel altar (YML/Acc.1967/11/v10/Fo.630). Between 1927 and 1929 the stoves and their chimneys were removed from the Lady Chapel during an overhaul of the Minster's heating system, thus eliminating an immediate and damaging source of coal smoke from the environs of the East Front (YML/Acc.1967/11/v11). This involved the re-instatement of ashlars in the Lady Chapel in Clipsham stone in the areas where the chimneys had once pierced the walls, along with a considerable amount of cleaning, colour-washing and 'preservation' of the interior stonework (YML/Acc.1967/11/v11). This continued into the 1930s, and further memorials were also moved. In 1934 the re-creation of St. Stephen's chapel began with the re-siting of the monuments of Sir George Savile and Archbishop Richard Sterne from the north and east walls (YML/Acc.1967/11/v12; Pattison and Murray 2001, 63, 96). On removal of the Sterne monument, the east wall of the chapel showed signs of considerable previous damage. This was remedied by cleaning and pointing. The arcade heads were renewed and a brand new parapet wall was fixed above. In terms of cleaning, it would appear that the methods employed were in fact a little too vigorous, with potentially disastrous consequences. A report was made to the SPAB stating that sand-paper was being used throughout the east end at this time (SPAB/Box138/YorkMinsterI), and the Detailed Time Accounts also record the removal of paint from the letters of the Kings of the choir screen (YML/Acc.1967/11/v12).

Similar changes were effected in All Saints' chapel in 1938 so that the appearance and function of the east end was unified once more. The vaults in both chapels were cleaned and re-coloured, and in St Stephen's it seems that further movement of the structure had necessitated some re-fixing of the vault-ribs and bosses, as well as the filling-in of cracks with grout. By now, the maintenance agenda had taken a necessary and uncomfortable turn, with the workforce steadily drawn away from the fabric in anticipation of war with Germany. During 1943 there were only two masons, and by 1948 a plea had to be made by William Jesse Green for craftsmen to join the cathedral to address

its urgent backlog of works (Green 1949, 38-39). Rather than renewing stone and repairing windows, dug-outs and shelters were being built around the Minster grounds during wartime, and preparation was made for the removal and storage of the Minster's precious stained-glass. The medieval panels of the Great East Window were taken out for their off-site protection, and the opportunity was seized upon by the masons to rapidly clean, point and grout the masonry at the same time during 1939 and 1940 (YML/Acc.1967/11/v13). However, photographic evidence of the façade from the 1940s shows that the return of the black sulphation to the stonework was nonetheless rapid, with decay appearing to be ongoing (Figure 63).

The protective measures for the window were finished with the removal of the protective glazing and glazing bars, the filling-in of the grooves and the boarding-up of the openings. At roughly the same time, it appears that some minor works to one of the north-east turrets was necessary as parts of a spirelet were renewed in July 1943. The reredos and shaftings in the east wall of St Stephen's Chapel were also replaced in 1945. By June of that year, when the threats of bombing or invasion were no longer feared, work began on the repair of the glass of the Great East Window in anticipation of its reinstatement (YML/Acc.1967/11/v14). The scaffold returned to the East Front for this purpose in July 1946, but before the glass was re-inserted the window was again cleaned and parts of the stonework, including the tracery, were pointed and 'made-up' with mortar. Holes and grooves were again re-cut for the glazing and its bars, which probably involved the removal of the earlier mortars which had been used to fill the spaces while the plain boarding was in place. The work was intermittent for several years, with the window finally completed in 1953.

During the course of the works to the window it appears that parts of the East Front had become unstable. Some of the 'finials' (most probably parts of the decorative parapet) of the south-east buttress of the east window had been taken down for safety as early as 1946 (YML/Acc.1967/11/v14). The suspicions that parts of the structure at high-level were not secure were realised when a

severe storm brought down the spirelet of the north-east turret on 31st January 1953 (Green 1954, 28). Extra scaffolding was put in hand to both of the northern pinnacles, as it was noticed that the top of the north buttress was swaying in the wind. The replacement of some of the spirelet stones ensued. Only the very top of the north buttress spirelet was renewed and re-fixed, but on the north-east corner it was found necessary to renew twelve feet of the upper part of the masonry in Clipsham stone. This also included new work to the ornamental corona at its base and a programme of pointing in cement. Attention then turned to the southern spirelets of the façade, which were also pointed their full length. Figure 64 showing the 1950s scaffold indicates the extent to which the façade was being examined. Again, some unstable ornamental stones at the head of the buttress were removed for safety, and the condition of the stonework was remarked upon by the Clerk of Works, William Jesse Green:

'Nearly all the hundred crockets are badly weathered and in some cases have completely disappeared. The base stones, which are very large, have wide open joints and are badly displaced by the effects of frozen water in the open joints. These most urgently need attention which it is impossible to give at the present time.'

(Green 1956, 38-39)

Soon after, the East Front was deemed a priority for repairs following the completion of the restoration of the West Front (Green 1957, 40-41).

During the works to the glass and masonry of the East Front in the 1950s a number of photographs were taken of the stonework that provide some valuable evidence for the condition and appearance of the masonry, and in particular the decorative elements around the Great East Window. Figures 65-71 show a number of the upper exterior carved voussoirs of the window and are the earliest known close-up views of these carvings. They show that the

details of the sculptures were still very crisp at this time and that the immediate hood-mouldings were also in a sound condition. However, all of the carvings that were photographed show signs of considerable darkening, due to both atmospheric soiling and previous treatments of linseed oil which are known to have been applied to the stonework of the window in the earlier twentieth century. Interestingly, it can be seen how certain carvings were being liberated of the soiling by surface rain-washing and appear less-darkened (e.g. in Figure 68). In other cases, signs of fresh decay can be seen, as in Figure 69, where the white granulation of the stone can be seen in stark contrast to the general pattern of surface soiling.

Further important photographs that were taken in 1955 include a number of shots of the seated figure within the apex niche of the Great East Window (Figures 72 and 73). Again, these are the only close-up images of the figure to have been found so far and provide the only insight into its previous form and condition. Figure 72 is a front view taken from the scaffold boards below which had been put in place to access the southern buttress. The figure appears uniformly weathered with some surface crazing of the lower section nearest the camera. The fingers of the left hand can be seen clutching a misshapen building, while the right hand is considerably weathered with its upper portion lost. Elements of the figure's clothing and posture can also be determined. Around the neck hangs some form of garment, perhaps intended to represent a pallium since the statue is mitred, and the legs appear robed and perhaps crossed. The facial features can be discerned, and the whole appears seated upon a weathered throne which rests upon a carved console. Further characteristics can be gathered from Figure 73. This shows that a considerable crack had formed through the bedding planes of the central stone along the facets of the clothing of the right arm. Towards the upper part of this crack can be seen an area of cement capping, most probably a remnant of the *in situ* repairs of c.1900. The joints of the three main stones of the figure also retain some form of dark cement pointing which may also be a remnant of the earlier repairs. The console on which the throne and figure rest also appears rather weathered,

with some surface veining and fine cracking apparent. Despite the fact that the statue was clearly accessible at this time, the archival evidence does not indicate that any attempt was made to clean or repair it.

Examples of other 1950s photographs which shed light on the condition of the East Front are given in Figures 74-80. Figure 74 shows a grotesque on the lower stages of the building that was probably a survival from the original construction. While the figure can be seen to have retained much of detail and form, heavy atmospheric soiling can be seen within the carved facets and on the underside of the stone where it was not being rain-washed. In other cases, the decay was leading to the complete loss of detailing, shown in Figure 78. In this example, the mouldings of this window were replaced in 1955 (Green 1956, 38-39). Insights into the structural behaviour of the façade were also noted during the photographic survey, whereby the crack above the easternmost window of the north clerestory was recorded thus:

'This settlement has been wedged with red brick many years ago and does not appear to have moved more than about ¼" since'

(YML/APYM/A71, 8 June 1954)

This fault is shown in Figure 79. The crack can be seen to have opened-up further since the repair of the clerestory in the 1840s. However, the mortar fillings to the crack appear very dark and therefore probably contained a proportion of cement. Being a less-forgiving mortar, and perhaps prone to more shrinkage, the degree of movement over those one hundred years may have been exaggerated.

The final photograph from this phase to include as an example is of the upper section of the south buttress (Figure 80). The condition of the masonry can be marked, where the whole appears weathered but free of decay. The restored details of the spirelet and corona remain fairly strong. The condition of the

ashlars below is noteworthy, which shows signs of considerable cracking across bedding planes and in areas where freeze-thaw cycles may have weakened the surface of the stone. Since the profile of the coping above the ashlars seems reasonably sharp in this image, it is feasible that this was also part of an earlier phase of renewal.

Here ends the exploration of the work of the first half of the twentieth century. These operations were necessarily protracted because of the intervention of two World Wars. The evidence presented shows that work had still carried on in much the same way as it had during the nineteenth century, albeit with different choices of stone for renewals because of the increasing dissatisfaction with the quality and performance of magnesian limestone. Alongside stone replacement, the masons' duties continued to involve the *in situ* repair of stonework from localised scaffolds using an array of preservation techniques in an effort to protect the façade from the threats of atmospheric pollution. However, by the late 1960s the attrition of the stonework through decay was replaced by a much greater threat to the fabric. After detailed inspection during 1965 and 1966 the then Surveyor to the Fabric, the late Sir Bernard Feilden, judged the Minster to be on the brink of collapse. The ambitious remedial works that followed included major interventions upon the East Front, and it is this phase of operations that forms the final section of Chapter 3.

3.6.3 The structural repairs of the 1960s and 1970s

Overview

The late-1960s campaign to underpin York Minster led to the most drastic and extensive works to the cathedral since the building operations of the fifteenth century. Stemming from a detailed inspection undertaken by Sir Bernard Feilden during 1965 and 1966 (YML/E7/1/1), the action taken to stabilise the structural problems of the Minster can now be seen as one of the most significant moments in the development of twentieth-century approaches to

conservation. Science and engineering were to occupy leading roles in the planning and execution of these monumental works, marking an inevitable shift away from the traditional dialogue between architect and craftsman in the maintenance of the fabric. Dubbed 'The Restoration of York Minster', the campaign lasted five years and saw the central tower and eastern and western gables stabilised with concrete and steel, and the stonework totally cleaned, both inside and out.

The various elements of the campaign were subsequently disseminated in a series of publications. An overview of the project can be found in Feilden's (1976) *Wonder of York Minster*, while more detailed insights into the engineering aspects of the work appear in Dowrick and Beckmann's (1971) 'York Minster structural restoration'. The unavoidable disturbance that was to take place below ground meant that the reinforcement of the structure was preceded by an intensive programme of archaeological excavation and recording. This was overseen for the first year by Herman Ramm, and then subsequently by Derek Phillips who saw the investigations through to their completion. A vast archive of drawings, notes and photographs was amassed during the course of the recording work, which informed two major publications (Phillips 1985; Phillips and Heywood 1995a; 1995b). While some of the interpretations of these discoveries will be revised and expanded by Norton and Harrison in their forthcoming study, Phillips's work still stands as a valuable contribution not only to the historiography of the Minster but also the discipline of church archaeology in general.

One of the great legacies of Feilden's tenure was the deposit of the project archive for the entire programme of works (YML/Acc.1977/5). This archive offers an important text to the restoration, offering detailed insights into the planning and execution of the works, from site meetings to weekly progress reports. Despite being superfluous to the needs of the publications at the time, much of this information, surviving as correspondence, memos or architect's instructions, has a renewed potential in shedding further light on this important

period, and the *minutiae* of the intervention that took place on the East Front. Since the published material has tended to focus on the main engineering work, and especially the strengthening of the central tower, attention has so far been drawn away from many other important aspects of the restoration. These include the programme of masonry replacement that was still going on, the associated problems of gaining appropriate stone, and the methods and potential effects of the extensive stone-cleaning operation.

Inspection 1965-1967

Shortly after his appointment in June 1965 Feilden began a thorough fabric inspection of the entire Minster. The findings were presented in a very detailed report submitted to the Dean and Chapter in January 1967 (YML/E7/1/1/v[4]1&2). This document outlined the urgent necessity for major repair works, and the desire for a substantial maintenance programme to address the problems of surface soiling and decay. Feilden envisaged a regular scaffold cycle of thirty years to mitigate the extent of stone replacement, whilst also placing emphasis on the need to renew carved figures and gargoyles to maintain the character of the Minster and its original design (YML/E7/1/1/v1, 6).

Through his exhaustive survey of the cracks and deformations that existed throughout the building, Feilden soon identified a serious need to intervene. Whilst recognising that some of the defects were 'good' in that they relieved stress in the structure, the cracking of the tower piers through to the foundations was seen as a cause for concern, especially as some of these fractures were deemed to be fresh. Feilden's initial theory that the tower was sinking was confirmed by the computer-aided analysis of the consultant engineers, Ove Arup and Partners, who concluded that differential settlement was occurring beneath the central tower (Dowrick and Beckmann 1971, 114-

[4] 'v' denotes volume number and has been added by the author

122). Some of the deformation and movement in the structure was accepted as being very old, although in retrospect a knowledge of the archival evidence for the frequency of attention to these phenomena would have helped to build a more detailed picture of the past behaviour of the structure, and whether or not movement had been continuous or intermittent.

While the collapse of the tower was not seen as directly imminent by Feilden, the urgency for the work to start was 'dictated by the fact that a point may soon be reached when the structure is too delicate to survive the strain of the repair operation' (YML/E7/1/1/v1, 3). In response, an appeal for two million pounds was launched to ensure the future stability of the building. After much planning and deliberation, a scheme was devised by Arups to strengthen the central tower by extending the pier footings with concrete, and by reinforcing the superstructure with a steel girdle and concrete ring beam (Dowrick and Beckmann 1971, 126-129). For the first time, the outward lean of the gables of the nave and eastern arm had also been recognised. Investigations into the causes were subsequently undertaken, and an underpinning solution was devised. This is discussed in greater detail below.

The East Front: form, condition and recommendations

Before considering the intervention that was undertaken upon the East Front of the building during this campaign, an overview of its form and condition as first viewed by Feilden c.1965 should be outlined (YML/E7/1/1/v2, 1070-1090). This section of the survey opens with a general description of the composition of the façade, noting its principal divisions and decorative scheme. The arch of the east window, and façade in general, was blackened with atmospheric soiling, which may have obscured the form of many of the carved details. The seventeen heads below the window sill were noted, as were the carvings within the arch of the window, of which Feilden counted ten. The seated figure at the apex of the arch was interpreted as Christ in Majesty, thus perpetuating the ambiguity of the statue's identity. Carved details were recorded as missing or decayed, including the cuspings of the detached screenwork within the upper

levels of the north buttress. The differences between the north and south-aisle terminations were also noted. The remnants of the Percy 'helmet and crest' above the southernmost niche of the first tier is mentioned, as is the lack of a corona at the base of the south-east turret spirelet.

At the end of this opening section, Feilden expressed his concern for the structural condition of the East Front. Despite previous attempts at repair, the cracks encountered were judged to still be expanding and the need for further investigation was made clear. Feilden believed that the extent of previous re-facing could have influenced the strength of the structure. Movement in parts of the façade to the east, north and south was observed. As a counter-measure, the possibility of extending (but not underpinning) the foundations was suggested, alongside the insertion of a deep strainer beam and steel ties across the middle and upper level of the east window. The introduction of ties to aid the resistance of the internal stresses of the arcades of the eastern arm was also considered here.

The survey continues with a systematic listing of the defects of the East Front and a consideration of the remedial options (YML/E7/1/1/v2, 1073-1090). As a general rule, heavily weathered or decayed elements were to be replaced, while cracks and open joints were to be pointed and monitored. Beginning at the south east turret, Feilden observed much weathering and decay around all faces, along with a multitude of cracks and open mortar joints. Previous eighteenth and nineteenth-century restoration from 'niche band 3' upwards was also noted. The eastern termination of the south aisle also exhibited a number of vertical cracks. Many had been re-pointed in the past, only to re-open once more. In general, however, the masonry was considered to be in good order with only the partial renewal of the plinth recommended.

The south buttress also showed signs of structural trauma. Vertical cracks were observed throughout the backs of the niches on the north and south sides. The niche mouldings and carvings were also observed as decayed in many instances.

The rebuilding of the apex, or corona, of the spirelet was also seen as desirable. Feilden's attention was again drawn to the restored elements of the façade, noting the 'over-refined' detail as indicative of restoration above the second tier of niches. The apparent correction of the eastward lean of the buttress back towards the vertical was also seen as a likely product of earlier restoration work, with the outward movement of the East Front deemed to have occurred during the original building process. If this was the case, then it may explain why the tilt of the façade is not mentioned by the commentators prior to Feilden, despite the fact that any scaffold erection would have revealed that the elevation was out of true. If the lean had been known anecdotally as a very old phenomenon then there would have been little cause for concern, and therefore no need to record it.

In the case of the centre portion of the façade, Feilden's observations are again valuable to the understanding of the repair history of the east front. At plinth level, some moulded stones were decayed and specified for renewal, and an old crack running up through the centre of the wall to the window sill was to be monitored with glass tell-tales. Fine cracks ran across the surface of the wall, and a number of sill stones were weathered and delaminating, requiring replacement. The east window itself was considered to be in good order overall. However, the mullions showed signs of slight displacement at the joints, and some weathering and decay to the tracery was also noted. Of greater concern was the condition of the north and south sides of the arch and spandrels above, which showed signs of cracking, decay and displacement. Unfortunately, no mention is made of the condition of the carvings within or above the arch, and only the renewal of moulded stones was specified. At the summit of the wall, the central parapet built with Ketton in the 1890s was deemed to be in good order, with the Ketton elements having weathered well. Eastward movement and cracking was noted at the junction between the 1930s parapets and the façade, and the structural problems were attributed to foundation troubles that would require further investigation.

Moving on to the north side of the façade, the central buttress exhibited many instances of decay to the carved and moulded elements and fine cracking to the rear faces of the niches. The eastern elevation on the north aisle presents a similar story to its southern counterpart, with an array of vertical and diagonal cracks running throughout the masonry. One of the headstops of the window was to be replaced as it was decayed, and the lack of bond between the aisle wall and the north buttress was noted. A number of mouldings of the blind arcading above the window required renewal, while the Ketton parapet above was in good order. Finally, the north-east turret was in need of renewals below the stage of the corona and, at the level of the traceried panels, structural overhaul was envisaged owing to the severe displacement of a number of stones. Vertical cracks ran throughout this angle, some of which were recognised as being old.

Despite Feilden's extensive specification for the renewal of weathered and decayed stones upon the East Front, the structural problems of the building understandably took priority. Indeed, archival and anecdotal evidence suggests that relatively little masonry replacement took place during Feilden's tenure. In the beginning Feilden was keen to place emphasis on the renewal of structural and protective elements, such as pinnacles, weatherings, and copings. However, after the completion of the engineering operations in 1973 the plan to overhaul the Minster was revised. This scheme specified the renewals that remained outstanding on the East Front, and now included the seventeen carved heads beneath the east window sill (Feilden 1976, 62; Figure 81).

The below-ground archaeology and the underpinning of the East Front

At first, the structural movement of the Minster was monitored with glass tell-tales, and the famous story of six breaking in the east end in one week was able to fuel much concern (Feilden 1976, 22, 89). However, Arups placed less faith in the tell-tales as reliable indicators of movement, and recommended the adoption of a more accurate and consistent means of monitoring the cracks using a 'Demec' gauge (YML/Misc/39/2119/X). With the use of these gauges

the engineers were able to build a more precise picture of the behaviour of the structure, and the plans to reinforce the central and western towers and underpin the East Front were carefully formulated. For the East Front, a small exploratory excavation and a graphical thrust-line analysis were undertaken. This enabled the position and behaviour of the gravity and wind-loads that were imposed upon the façade to be calculated (Dowrick and Beckmann 1971, 138; Figure 82). Taken together, the investigations revealed that the foundations were poor, having no toe and being built without mortar (Dowrick and Beckmann 1971, 137, 140). The tendency for the wall to continue leaning because of the thrusts imposed by the internal arcades was identified, along with the fact that the gable was acting separately in two halves either side of the crack beneath the east window. The foundations of the south half, at least, were behaving as a rigid body, and the capacity for the clays beneath the footings to yield further meant that underpinning was seen as the only solution to prevent the façade's collapse (Dowrick and Beckmann 1971, 142). The excavations that lie at the heart of this procedure can therefore be divided into three main phases: (i) the making of the bases of the raking shores in 1967-8, which would stabilise the façade during underpinning; (ii) the complete replacement of the substructure of the east wall itself from September 1968 to November 1969; and (iii) the sinking of a bench mark, BM 2 in May 1969 (Phillips and Heywood 1995a, 25).

It is a great credit to Feilden, the engineers and the contractors that, wherever possible, provision was made throughout the project for the integrated investigation and recording of the Minster's historic substructure. However, it must also be remembered that the excavations were necessarily led by the needs of the engineering programme, rather than by archaeology alone. The extent and resolution of the information recovered was to vary depending on the timetable, the numbers of staff available, and the type of reinforcement procedure involved. For example, in the area surrounding the central tower a considerable amount of soil removal was required in advance of encasing the crossing piers, presenting a good opportunity to examine and redefine the early

history of the eleventh-century cathedral (Phillips 1985). On the other hand, the perceived urgency and format of the underpinning scheme for the east front meant that comparatively little information could be recovered from this area, save for a handful of photographs and elevation drawings of the foundations first exposed during the investigative dig in the north-east angle of the south buttress (Phillips and Heywood 1995a, 25-26; Dowrick and Beckmann 1971, 137; see Chapter 4, section 4.3.1). These are examined in Chapter 4 of this thesis when the archaeological sequence of constructing the east front is dealt with in greater depth.

The excavations at the east end were undertaken by the contractors, Shepherds, between 1967 and 1969. These excavations were accompanied by basic archaeological monitoring where possible. However, this became increasingly difficult during the tunnelling-out of the fourteenth-century foundations. As Figure 83 illustrates, the removal of the medieval footings was facilitated by their systematic extraction of 4ft-wide 'headings', with each heading filled with a baulk of concrete before moving on to the next. Teams of contractors worked simultaneously, starting with the interior piers and buttresses, before moving from the outer corners of the façade towards the centre, always keen to ensure that the changes in support for the wall remained balanced throughout (Feilden 1976, 29). The consequence of the underpinning was that the East Front was successfully stabilised without any major trauma to the fabric. Sadly, however, the necessary strategy for cutting out the old footings had meant that an opportunity to observe and record the medieval foundations as a piece had been denied.

Finally, it is important to remark upon the introduction of some further reinforcement of the east-end superstructure during the underpinning process. Concrete 'stitcher blocks' strengthened with steel joists and stirrups were built across the major cracks of the East Front. These were located below the east window, and in the walls of the chapels of St Stephen and All Saints. The base of the east wall was also grouted with 'Sulphacrete', as were the main piers of the

Lady Chapel arcade. This sought to enhance the pier and wall cores to re-assert their ability to absorb the loads of the arches above (YML/Misc/15/2119/Biii). The vaults above the aisle altars were also re-set to correct the distortion and separation that had originally occurred as a result of the eastward movement of the end wall.

The reinforcement of the Great East Window

The protection of the east window had been an ongoing concern of the architect and engineers. During the erection of the raking shores a system of temporary steel reinforcement had been fixed to the window exterior, along with 'claritext' shielding in front of the glass (YML/Misc/15/2119/Biii). After the completion of the underpinning, it became desirable to address the lean and bow of the mullions and tracery with a longer-term solution. Since the condition of the individual stones was of less concern, it was decided to enhance the stability of the window *in situ*. This avoided the necessity to dismantle the window and remove its glazing (Dowrick and Beckmann 1971, 141-142; Figure 84). This involved the installation of four steel cables, or 'bow-strings', the intention being to strengthen and restrain the masonry against wind loads between the level of the interior gallery and the apex of the tracery. The cables were deeply anchored with grout at intervals between the interior walkway at the springing-point of the arch and the apex (Feilden 1976, 29; Dowrick and Beckmann 1971, 142). Despite the fact that the gallery was performing as a flat horizontal arch, which therefore stiffened the window, it was still felt necessary to intervene.

The maintenance programme: cleaning and repair

As has already been noted above, a general maintenance regime ran alongside, and subsequent to, the engineering operations. In the long-term, Feilden sought to implement a structured maintenance regime for the cathedral which did not focus solely on masonry replacement (YML/Misc/15/2119/Aii). Regular attention to the fabric was encouraged, including the cleaning of the masonry every ten years. This would not only maintain the aesthetic quality of the

Minster, but also keep it free of the pollutants that would otherwise lead to decay.

In spite of the earlier attempts to keep the building clean, when Feilden arrived in 1965 the Minster's exterior was still heavily coated with atmospheric soiling. In sheltered zones the resultant sulphation appears to have been at an advanced stage (Figure 85). The interior was also dark with soot and dirt (Figure 86). The surveyor's solution was to initiate a thorough water-cleaning of the cathedral from a veil of scaffolding both inside and out. In the main the cleaning was undertaken by Shepherds, although the Minster's 'Heavy Gang' of labourers were responsible for some areas. Feilden continually urged care and restraint in the way the work was conducted. However, regrettably, there were instances where it appears that his specification was being breached. Concerns over the use of wire brushes were expressed, and the over-spraying of the masonry was also noticed by the surveyor (YML/Misc/7&8/2119/11; YML/Misc/18&19/2119/11). This matter was of particular concern to Feilden, as it was recognised that the saturation of the stonework might easily lead to the problems of staining and efflorescence. Indeed, an increasing awareness of the decay of the carved elements of the Minster is marked in the Feilden Archive, and in particular the Great West Doorway, after this programme of cleaning (YML/Misc/31&32/2119/26).

The cleaning and treatment of the interior and exterior walls of the east end was undertaken during 1970 and 1971 and coincided with the photographic recording of the façade by the Royal Commission on the Historical Monuments of England (RCHME; Figures 87-92), Broadly speaking, the operations were divided between the contractors, who would wash the masonry, and the masons, who would follow on with minor repairs. Inside, the interior masonry was cleaned and limewashed by Shepherds to brighten the elevations and disguise earlier staining. Outside, a sustained period of water-washing was undertaken in November and December 1970 and between April and October 1971. After an area of the façade was cleaned, the stonework was 'made good'

with new stone indents and epoxy resin repairs. Parts of the east window were also painted by the contractors, perhaps to disguise staining or to consolidate the patches of decay that Feilden had noticed during his initial fabric survey.

Confirmation of Feilden's instructions for the repair of the east front was made in February 1971 (YML/Misc/15/2119/Aii). New masonry work was to be to a thirty-year standard, and stones with at least thirty years structural life were to be retained. Attention was to focus on weatherings as these elements served to inhibit the deterioration of adjacent masonry. The replacement of a certain number of Ketton stones was agreed, along with some cracked magnesian limestones. In the case of the east window, a thin mix of epoxy resin mixed with stone dust was to be applied to the thin sills of the main lights. To avoid the replacement of any of the tracery stones, damaged areas were to be built up on a copper armature with epoxy resin and stone dust. Final recommendations included the renewal of the weathering courses below the east window, and the replacement of some of the carved heads and plinth stones below. In the case of the carved heads, a decision regarding their replacement would not be made until they had been inspected after cleaning. In the event they were to remain unchanged.

The revival of magnesian limestone for repair

To avoid altering the overall appearance of the Minster, Feilden sought to reinstate the use of magnesian limestone over Clipsham from an early stage (YML/E7/1/1/v1, 6). In 1965 the search for a new stone source began, with enquiries first made at the quarries of Bramham Moor, Jackdaw Crag and Smaws in the Tadcaster area. By now, these quarries had been used for hardcore extraction or lime-burning for some years (YML/Misc/39/2219/T). Despite various quarry trips and rounds of sampling, these sources were deemed unsuitable for use at the Minster, either because of inconsistent bedding patterns leading to excess waste, or because the method of extraction was inappropriate for supplying dimensional stone. Other local quarries were also briefly considered, including Hampole, Newthorpe and even Hovingham

(not magnesian), and some experimental renewals were undertaken in Portland Stone. Eventually, the re-opening of the Huddleston quarry was identified as a more positive option in 1969. An agreement was drawn up between the Minster, the owner, and the operators of Hovingham quarry, who would undertake the extraction and sawing of the stone. The burning of Huddleston for mortar and limewash was also requested by Feilden (YML/Misc/5/2119/Aii). However, whether this was actually followed up is not clear from the archive.

Initial supplies of Huddleston proved to be satisfactory, but problems gradually arose relating to the way the stone was being extracted. Many faces were found to be wedge-bedded or trapped by overburden (YML/Misc/18&19/2119/Aii; YML/Misc/15/2119/Aii). The lack of traditional quarrying skills was telling. Attempts were made to remove the blocks as superimposed drilled-out rectangles, without any attention paid to the natural faults of the stone. Moreover, the quarry owner had restricted extraction to the north faces of the quarry, which were already known to contain laminated material of inferior quality. Better stone was located in lower beds to the south, but this was inaccessible owing to the presence of the owner's house and farm buildings directly above (YML/Misc/31&32/2119/26; Brooke 1976, 12). In 1974 the agreement to work the quarry came to an end and the site closed, with attention turning towards alternative sources of stone. Sprotborough and Roche Abbey were considered, as were the French limestones of Lepine and Besace. Feilden, however, remained keen to maintain the aesthetic and chemical compatibility between the old and new stone on the building. Supplies were temporarily obtained from the Tadcaster quarry at Highmoor, where quarrying had been restarted by the Samuel Smith brewery company. Yet again, however, the quality and suitability of bed-heights of the stone declined as extraction progressed, and its use was short-lived. Stone was then briefly obtained from Maltby, before abrupt changes in ownership forced the Minster to turn to the quarry at Cadeby, near Doncaster. This stone was used for repairs into the 1990s in conjunction with Warmsworth for delicate work, and French Lepine

where large bed-heights were required for the Great West Window restoration (YM/E7/2/5, 45).

3.7 Conclusion

It is with the end of the tenure of Sir Bernard Feilden in 1977 that the examination of the documentary evidence for the construction and repair of the East Front also ends. This chapter has demonstrated the complexity and richness of the archival information that can be drawn upon to shed light on the history of the façade. The chronology of building *and* repair has been examined in depth for the first time, and a closer investigation of the people, processes and materials used in these activities has been undertaken.

The implications of this level of understanding will be considered more fully in the final section of this thesis following the archaeological analysis presented in Chapter 4. However, in concluding the present chapter it is important to note the key themes that have emerged so far. In regard to the construction campaign of the East Front from 1361 onwards, the contemporary documentary sources indicate that Thoresby's east end, and therefore the East Front, was built in great haste with much reclaimed stone systematically removed from the twelfth-century choir. Structurally complete by Thoresby's death in 1373, the glazing of the façade and the completion of its high-level work followed over the next fifty or so years. By the last quarter of the fifteenth century repairs to the masonry and glazing of the eastern arm were already underway, and would become the standard responsibilities of the masons and glaziers over the centuries that followed. The cyclical attention to decorative and high-level work has been recognised, and by the time of John Carr in the 1770s it appears that much of the exterior stonework of the cathedral was suffering due to the effects of atmospheric pollution. This prompted a long-term repair programme on the Minster supervised by William Shout until 1827, followed by the two major restorations after the fires of 1829 and 1840. Repairs

continued on the East Front during the 1840s and 1850s, and resumed in the 1890s.

Several campaigns of intervention continued on the East Front during the first half of the twentieth century in response to both pollution-related decay and the need to protect the glazing. In time, the pressure of two World Wars was to take its toll on the maintenance of the building. The onerous task of removing and protecting the Minster's precious stained glass during both phases of conflict drew attention away from the stonework, and this backlog of maintenance was compounded by the increased lack of available craftsmen during the 1940s. By the 1950s much of the Minster exterior was in desperate need of repair, a problem masked only by the structural crises of the 1960s. The engineering and restoration works initiated by Sir Bernard Feilden sought to redress this situation, and involved the reintroduction of magnesian limestone for renewals and the wholesale cleaning of the cathedral.

This chapter has also shed new light on the materials and methods employed in the construction and repair of the East Front. The different sources of materials over time have been considered, offering a valuable platform from which the archaeology of the fabric can be analysed. Localised scaffolding cycles were preferred, and pointing and *in situ* repairs with mortar and plaster were routinely undertaken along with the application of surface coatings to protect and prolong the life of the Minster's stone. In turn, the recognition of these past practices significantly extends the remit of the traditional role of the mason at the cathedral, while also raising important questions regarding the effect that some of these methods may have had on the fabric over time. These issues will be explored further in Chapter 4, which will examine the interplay between the archival evidence and the archaeology, form and condition of the façade.

CHAPTER 4

CONSTRUCTION AND REPAIR ~ *The Archaeology*

4.1 Introduction

Chapter 4 explores the archaeological evidence for the construction and repair history of the East Front. It begins by presenting an overview of its design and the previous scholarship that has sought to shed light on its medieval history and meaning. This is followed by the first systematic guide to be published on the materials and technologies that have been used for its construction and repair. A detailed survey of the fabric then follows to form the key section of this chapter. This survey begins at foundation level, and is completed with a detailed analysis of the Great East Window and its sculpture. It will be seen how the process of cleaning, conservation and stone replacement can shed new light on the construction and repair processes, and how archaeological analysis can extend the understanding and appreciation of the building beyond its principal phases of construction. As has already been raised in Chapter 1 and will be discussed in Chapter 5, the understanding of past repairs is especially critical when anticipating the need for conservation. Recognising the nature and extent of past repairs can reveal evidence of failure in the past, highlighting areas prone to exposure, decay or structural weakness. In turn, this can inform current repair strategies, with the decision to retain or replace stone underpinned by an archaeological understanding of the condition and behaviour of the fabric.

Before presenting an overview of the main architectural aspects of the East Front it is important to consider the circumstances in which previous analyses of its form and fabric were developed, and the extent to which this part of the Minster is currently understood. This thesis seeks to add to, and not detract from, these studies. Before the work of Browne (1847; 1863) and Willis (1848)

the existence and significance of the Fabric Rolls remained unrecognised. Thereafter, the architecture began to be read from these sources so that a tradition of setting the building against an intricate chronology was established. The major works of Gee (1977), Harvey (1977) and, most recently, Brown (2003) have maintained and extended this trajectory. These studies have added considerably to the nineteenth-century histories of the cathedral by including detailed explanations of the architecture, with particular emphases placed on ornament, style and patronage as well as the evidence for major construction breaks. However, these works understandably have their limitations. The contributions of Gee (1977) and Harvey (1977) were based on observations of the fabric made at ground level (Richard Morris pers. comm.), and without the benefit of seeing the building in states of undress during repair work. As already noted in Chapter 1, few areas of the Minster have been analysed archaeologically stone-by-stone above ground, with the exception of the Chapter House Vestibule and several of the Chapter House buttresses (Giles 2001; Holton 2006). As a consequence, a thorough understanding and record of the sequence of construction and repair for any major part of the building remains unattained, with the scaffolding of the East Front providing an ideal opportunity to address this shortfall.

Sarah Brown's (2003, 144-164) synthesis of the architecture of Thoresby's east end provides an excellent platform from which to interrogate the design and construction of the East Front. This detailed account emphasises the horizontal development of the façade from 1361 onwards, and suggests that work had progressed fairly quickly and evenly to the springing point of the Great East Window, when a change in design was initiated. The casement mouldings of the Great East Window alter at this level (Figures 93 and 94) and the form of the north and south clerestories develops from blind screenwork in the easternmost bay to pierced screenwork in the subsequent three bays to the west (Figure 95). Both aspects have been cited as features which could be connected with the transition in master masons in 1369 from William Hoton the younger to Robert Patryngton, considered earlier in Chapter 3. Generally speaking, the upper levels of the façade and clerestory are thought to have been

conceived as a unit, with structural completion achieved by Thoresby's death in 1373 and the introduction of the Great East Window mullions and tracery by 1405 (Brown 2003, 141, 160). Exactly when the installation of the masonry units of the window took place is still open to question, however, as is its potential dialogue with the glazing scheme. In particular, the form, date and meaning of the sill and exterior and interior voussoir carvings remains largely unexplored, as does their potential relationship with the iconography of the east window glazing itself.

4.2: The East Front: form, construction patterns and materials

4.2.1: Overview: form and context

Figures 96 and 97 provide outlines of the eastern termination of the Minster. The East Front takes the form of a 'screen façade', being an elevation that is almost completely flush, save for the shallow projection of its buttresses and corner turrets. The choice in design was heavily influenced by a series of existing thirteenth and fourteenth-century buildings (Brown 2003, 156-157). Whilst general comparisons can be made with the eastern terminations of Ely (1239), Lincoln (1256) and Ripon (1288) (Figures 98-100), the most important sources of inspiration for the East Front came locally from innovation in design at the churches of Howden and Selby in South Yorkshire (Figures 101-103), and even more immediately from the nave of York Minster itself (Brown 2003, 145, 147). The west and east facades at Howden were built in c.1300 and c.1320 respectively, and bear particularly close resemblance to the form and motifs of Thoresby's East Front (Coldstream 1989, 110-111). Only one statue remains upon the exterior of Howden's eastern termination, but, as a nineteenth-century reconstruction by Edmund Sharp illustrates, it was once adorned with figurative sculpture at every level (Coldstream 1989, 111; Figure 104). The handling of the niches at York suggests that a similar scheme was also envisaged. However, archaeological evidence for the nature and extent of any such scheme is distinctly lacking because of the degree of post-medieval stone replacement on the East Front. Arguably, this work would have steadily

removed evidence for fixings in the niches that would otherwise confirm the former presence of statues. This leaves the figures of Percy and Vavasour in the outermost niches of the lowest tier and the seated figure in the apex niche as the only confirmed examples of niche-statuary on the facade.

Having brought the architectural dialogue between these Great Churches to a climax, the East Front went on to influence subsequent building projects at Beverley Minster (Figure 105) and the Abbey at Melrose, Scotland[5] (Figures 106 and 107). At Beverley, the east wall and window were re-modelled with obvious acknowledgement to York c.1416 (Raine 1865, 57). Melrose was rebuilt after its destruction by Richard II in 1385 (Fawcett and Oram 2004, 86). The elevations of the south transept and choir of the abbey bear significant similarities with the Minster in their design and detailing, with the Yorkshire connection also emphasised by Fawcett and Oram (2004, 105).

The exterior of the East Front is articulated by horizontal bands of masonry. These offer a convenient means of reference and are used to describe and analyse the archaeology of the East Front in Section 4.3.1 below. Indeed, attention has already been drawn to this aspect of the façade, where it has been suggested that the construction sequence of Thoresby's campaign developed horizontally, wrapping around the existing twelfth-century choir (Brown 2003, 154, 158). While the stylistic evolution of the façade can be read with comparative ease, the analysis of the pattern of construction within and between these changes requires more careful thought. Notwithstanding the alterations resulting from the interventions outlined in Chapter 3, the pattern of building is difficult to interpret for two reasons. The first is inherent within the design, in that the masonry of Thoresby's east end is heavily moulded and faceted. With the exception of the work between the exterior plinth and window sills and in the upper-side elevations of the central buttresses, there are few expanses of plain ashlar which might otherwise facilitate the straightforward

[5] I am grateful to Professor Christopher Norton for drawing my attention to the possible links with Melrose.

identification of seasonal breaks or the process of construction. Secondly, Figure 97 shows the inconsistency in the size and shape of the stones that were used to build the façade, and therefore the lack of regular masonry coursing. This is especially apparent in the spaces above and around the arches of the aisle windows. This is likely to have emanated from the use of the reclaimed twelfth-century stone already noted in Chapter 3. Although the nave appears to have acted as a key source of reference for the architecture of the eastern arm (Brown 2003, 144), the strict approach to building exhibited on the western façade, for example, does not appear to have been carried over to the East Front. Finally, while it has been possible to inform construction sequences on other major medieval buildings through the reconstruction of scaffold patterns (e.g. Ayers and Sampson 2000, 20-24), the general lack of consistent putlog systems or their re-use on the East Front means that in this case such an approach is far less rewarding. That medieval scaffolding was frequently cantilevered from niches and ledges may well account for this, with ample opportunity available for this access method within a Perpendicular construction such as the East Front.

However, the understanding of the phases of building and repair can be more reliably informed through an analysis of the key structural anomaly of the East Front – its progressive eastward inclination. As Chapter 3 notes, this was first recognised by Sir Bernard Feilden (YME7/1/1/v2) who suspected that it had begun to occur during construction. However, without detailed recording methods to hand he was unable to undertake a thorough assessment of this phenomenon. Therefore, it has only been in the light of the 1997 photogrammetric survey that this has been explored further. This survey has enabled the accurate measurement of the angles of tilt of the eastern faces of the masonry, as well as the interior newel stair of the south buttress turret and the horizontal bed joints of individual stones. Overall, the façade appears to have accrued an eastward inclination of 700mm on the south side and 500mm on the north side (AA/RCA/RS/E.1 12Jan06, 1; AA/pm/832/02/CFCE, 2).

Arising from regular meetings and on-site discussions, the Surveyor to the Fabric reports prepared in advance of submissions to the Cathedrals Fabric Commission of England (CFCE) present a series of hypotheses which examine the general sequence of building and the creation of the outward lean (AA/RCA/RS/E.1 12Jan06, 1-2; AA/pm/832/02/CFCE, 1-5). These investigations have concluded that the East Front had begun to lean early-on and that the medieval builders had attempted a series of 'mid-course corrections' up to the springing level of the Great East Window. By this point, the façade was leaning by approximately 1°. A pause in construction is thought to have ensued, before the remaining upper-levels of the façade were built to a renewed vertical plane. Thereafter, over the subsequent six hundred years, the wall continued to move eastwards. As a result, the masonry below capital level gained a tilt of 2° and the levels above 1°.

These patterns of tilt have also been used to explain the repair history of the upper levels of the East Front, whereby those areas that reflect corrected bedding planes towards horizontal and plumb are assumed to indicate areas of post-medieval renewal and/or reinstatement. So far, attention has been focused on the south buttress turret and spirelet, defined as Area 2 within the current repair programme (AA/pm/832/02/CFCE). In this area the sequence of repair was viewed as particularly complex and has been conveniently placed within the nineteenth century. However, the archaeological survey that follows, supported by the archival evidence presented in Chapter 3, suggests that the sequence of alteration at these levels is even more complicated than has previously been thought. This justifies the need for a closer analysis of the façade to un-pick the true complexity of this palimpsest in order to define the history of structural problems, attempted solutions and changes in design.

4.2.2 Analysing the fabric: materials

Section 4.2.2 provides a systematic summary of the key characteristics of the materials employed in the building and repair of the East Front. It is important to outline these characteristics here as they provide the key to reading the

fabric stone-by-stone and underpin much of the analysis that follows in section 4.3. As will be seen throughout this chapter, recognising the types of stone used along with any evidence of surface tooling is especially critical in understanding not only the archaeology of the stonework of the East Front but also the Minster in general. In this respect, tooling is especially important, as it is often the only means of confirming the date of a particular stone. On the exterior, such finishes usually only survive within concealed joints, which places special emphasis on the need to witness the dismantling or removal of stones *during* repair. A consideration of the various stone types used in the past by date can also enhance the understanding of rates of failure, and whether or not the same source of stone would be suitable for use today.

A basic classification of mortars by appearance and date is also included in this section, as knowledge of the composition, date and application of these materials can also shed useful light on the approach to repair in the past as well as rates of surface attrition and potential causes of decay. Likewise, the visual recognition and performance of past surface treatments is also a useful indicator of whether or not these materials have been harmful to the fabric, and if their re-application should be considered, or guarded against, in the future.

Stone and tooling: overview

Figures 108-127 provide sample images of the various types of stone that were previously used on the East Front and their likely date, as well as examples of the stones currently employed from the quarries of Highmoor, near Tadcaster, and Warmsworth, near Doncaster (Figures 124-127). These dates are informed by the archival information outlined in Chapter 3 combined with the basic characteristics of the stones themselves. These include colour and texture, the manner in which they have weathered and the evidence of surface tooling. In general, it appears that the phases of renewal have been faithful to the original pattern of construction, with bed-heights and block-widths routinely respected. Exceptions do occur, however, especially where only the mouldings of a stone have been re-faced. This is particularly the case on the central buttresses. It is

also common for post-medieval carved work to be significantly simplified in contrast to its predecessors. The different types of stone and tooling are outlined below.

Stone

Magnesian limestone – Tadcaster (fourteenth century) (Figures 108 and 109): On the exterior, the original medieval stone from the Tadcaster quarries weathers to pale yellow or yellow-grey. Within the interior, the stone is yellow to pale yellow also. When freshly broken, the newly exposed face is commonly a stronger yellow colour with dark grey flecks of iron oxide visible. The clear definition of bedding planes through differential erosion is a typical weathering feature of this stone. Calcite veins are also common.

Magnesian limestone – Tadcaster (1820s and 1830s) (Figures 110 and 111): The nineteenth-century Tadcaster stone is typically more yellow to yellow-orange in colour with a softer texture. Iron-rich veining is also common. The stone is highly susceptible to salt-related decay and is also frequently found to be incorrectly bedded. The clerestory cornice of the 1830s is a sustained example of the fixing of the stone in this manner.

Magnesian limestone – Huddleston (fourteenth century, after 1385) (Figures 112 and 113): So far, medieval Huddleston stone has only be identified within the primary core work of the uppermost level of the south buttress (see Section 4.3.1 Level F, below). The stone appears to have been obtained in larger bed-heights in comparison to the Tadcaster material, and is creamy-white to grey in colour with a more crystalline appearance. Inside, it appears to have been used for the screenwork of the Great East Window and within the north and east walls of St. Stephen's Chapel.

Magnesian limestone – Huddleston (1840s and 1850s) (Figures 114 and 115): The nineteenth century Huddleston is generally of inferior quality when compared to the other magnesian limestones on the East Front. Indeed, the rate of the decay of the nineteenth century Huddleston within the north buttress is

at least equal to, if not in advance of, the rate of deterioration shown by the nineteenth century Tadcaster stone in the south buttress. It weathers to a grey-white, with exposed surfaces creamy-white in colour with flecks of iron oxide visible. Again, it has a slightly crystalline appearance.

Magnesian limestone – Huddleston (1970s) (Figures 116 and 117): On the re-opening of the quarry under the auspices of Sir Bernard Feilden, the use of this stone appears to have been reserved for the renewal of moulded and decorative features. It is similar in appearance to the nineteenth-century Huddleston and shares similar weathering characteristics.

Magnesian limestone – Cadeby (1970s-1990s) (Figures 118 and 119): This stone is yellow brown in appearance and frequently bears shelly inclusions. It is susceptible to premature weathering, with sections of the south aisle parapet gablets already exhibiting symptoms of failure.

New Ketton oolitic limestone – (1895-c.1920s) (Figures 120-121): The Ketton stone is easily identifiable, being composed entirely of well-defined ooliths bridged by calcium carbonate. Colours range from grey through buff to brown. The stone can suffer from severe cavitation, but generally weathers through the disaggregation of the ooliths.

Clipsham oolitic limestone – (1920s-1960s) (Figures 122-123): This stone is coarsely textured bearing large fragments of shell. It weathers to a dark brown-grey colour and has proved to be extremely durable so far.

Tooling

Diagonal plain axe tooling (Figure 128) – Used from the late eleventh century until the late twelfth century, the plain axe or adze appears to have been the staple tool of the Minster masons. In the extant eleventh century work of Archbishop Thomas of Bayeaux, the masons finished the stone with broad, bold strokes. By the work of Archbishop Roger of Pont L'eveque in the mid-twelfth century, tighter finishes were being achieved. Presumably, this owed much to the finer grain of the magnesian limestone then in regular use (Phillips 1985,

189-190). It also appears that claw axes and chisels were introduced during Roger's work on the choir, although their use was comparatively limited (see Echtenacher 2006).

Claw axe or chisel tooling (Figure 129) – Claw tools became the principal means of working stone at the Minster from the thirteenth century onwards. Their use appears to have died out by the time of the eighteenth century repairs, before re-emerging during the second half of the nineteenth century.[6] The advantage of the claw axe or chisel was its efficiency in removing excess material, with each striking action concentrated onto the smaller surface areas of the teeth of the tool. Furthermore, the tendency to 'pluck' or flake the surface of the stone was much reduced because each blow was dispersed evenly through the tool, rather than through the middle of a single blade. Claw tools impart an attractive textured finish, which may have also provided a key for plaster or polychrome finishes on certain stones.

Punched tooling (Figure 130) – The medieval masons often used a plain-pointed 'punch' to roughly pitch off any unwanted excess before more controlled rouging-out with a claw tool. The punch offered speed in working and, being less-finely tipped than a claw tool, required sharpening less often.

Abrasive or 'drag' tooling (Figure 131) – Smoother, finer finishes to moulded and carved work was achieved with an abrasive or 'drag' tool. These tools impart fine, regulated lines to the surface of the stone and can be differentiated from the rough scoring created during later phases of cleaning with wire brushes.

Plain bolster or boaster tooling (Figures 132 and 133) – Plain-edged bolster chisels became the standard masons' tool during the post-medieval period. The simplicity of these chisels meant that they were easier to produce. Unlike the claw tools, bolsters did not impart an overly-textured finish. They were

[6] Nineteenth-century claw tooling can be seen on the columns of the south transept doorway replaced during GE Street's restoration in the 1870s

therefore more appropriate for the production of classical forms, which demanded smooth, clean lines and surfaces. The nature of bolster tooling can vary depending on the context in which it is being used (either on the bed or back of the stone, or on the exposed finished face). Bolster strokes may run diagonally, horizontally or in a chevron pattern, and are broader than the twelfth-century axe finishes.

Twentieth-century claw tooling (Figure 134) – with the reintroduction of magnesian limestone in the 1960s came a renewed use of the claw tool, especially by the Minster carvers. Until then, the stone from Clipsham had been too hard to work with such tools, with plain bolsters or punches being the favoured options.

Mortars and cements

A detailed study of the mortars and cements used to build and maintain the East Front lies beyond the scope of this thesis. However, it is important to acknowledge the extent and nature of these materials, not least because mortar lies at the very heart of construction and repair in stone. Phases of pointing or mortar repair can shed light on the remit of a repair campaign, especially if masonry renewal has been limited (as was the case during the 1950s for example). Moreover, the observation of different mortar types can raise further questions relating to the decay, or preservation, of the stonework. These observations will be considered in greater depth in Chapter 5.

Fourteenth century lime mortar (Figures 135 and 136): the fourteenth century mortars are best observed on the interior of the East Front within the stair wells or passages where cleaning and re-pointing has been kept to a minimum. Whilst the archival evidence suggests that magnesium lime was used as the binder, this hypothesis will in time benefit from scientific analysis being undertaken by Rachel Walker[7] to determine whether or not this was actually

[7] PhD candidate, Department of Chemistry, University of Cardiff

the case. Basic disaggregation tests show that the mortars were 'binder-rich' and hot-mixed, i.e. the quicklime was slaked directly with the aggregate (Womersley 2007). Particles of 'air-slaked' lime are present in these mixes, along with stone chippings, sub-angular silica sands and coal-ash from the burning of the lime. Overburnt and underburnt lime has also been noted. The stone dusts would have been necessary to enhance the aggregate grading, as the use of finer, sub-angular sands alone (perhaps indicative of the use of river sands, see Chapter 5) would not have provided a sufficient structure to the mortar. From the limited number of samples analysed, lime:aggregate ratios range from 1:1¾ to 1:3.

Post-medieval lime mortar (Figures 137 and 138): a similar mortar to the fourteenth century type, but incorporating crushed tile or brick as a pozzolan. Pozzolans were used throughout the Roman period, but it is assumed their use died out until their reintroduction in the sixteenth century (Swallow and Carrington 1995, 20).

Early nineteenth-century mortar (Figures 139 and 140): These mortars were used during the time of William Shout. The archival evidence reviewed in Chapter 3 suggests that they were also hot-mixed and contain stone dusts, fuel-ash and sand, probably sourced from the Ouse or Foss. Again, the archives indicate that these mortars included magnesium lime as the binder, and by the 1840s there is explicit evidence for this for work on other parts of the building (Wylson 1845, 159). Significantly, the early-nineteenth century masons undertook mortar repairs to existing stones. The approach was generally very simple, where cavities were filled with the regular bedding and pointing mix. In some areas, however, attempts where made to reinstate detail or to build-up weatherings. Some of these repairs were anchored with lead or iron nails, and large cavities were filled with faced-bedded stone slips, brick or oyster shell.

Mid nineteenth-century mortar (Figures 141 and 142): The mid-nineteenth century mortars found on the East Front are similar in character to those used by Shout's men, but appear to incorporate an aggregate of increased particle size. Magnesium lime derived from the burning of Huddleston stone was used

during the restoration of the West Front after the destruction of the nave by fire in 1840 (Wyslon 1845), and so it is highly likely that the subsequent works on the East Front also involved the use of magnesium lime.

Late nineteenth/early twentieth-century mortar (Figures 143 and 144): By this date the mortars incorporated a significant proportion of cement, and were often darkened with lamp-black or ash to unite them with the sulphated stonework. The aggregate composed of sand and crushed Ketton limestone, rendering these mortars easily recognisable because of their oolite inclusions. These mortars where used for pointing and fixing, and for filling pockets of decay.

Mid twentieth-century mortar (Figures 145 and 146): by the 1950s the use of Ordinary Portland Cement (OPC) had become widespread in the UK. This was used almost neat on many parts of the East Front at high-level. It is recognisable as a dense, brittle, dark-grey mortar.

Late twentieth-century mortar (Figures 147 and 148): This mortar was used during and after the repairs of the 1970s. The mix was based on white cement, sand and stone chippings, and is creamy-brown in colour. Its prolific appearance across the East Front shows that the façade was holistically re-pointed with this mortar during the tenure of Sir Bernard Feilden, alongside the limited amount of stone renewal.

Current bedding and pointing mix (2007 onwards) (Figures 149 and 150): The current general mortar mix was informed by the analysis of previous mixes undertaken by Mark Womersley (2007). This mix is intended to replicate the appearance of the fourteenth century mix and is composed of: 1 St. Astier NHL[8] 3.5: 1 Nosterfield washed river sand: 1 Leyton Buzzard sand: 1 North Cave fine sand: 10% magnesian limestone chippings: 0.5% fuel ash.

[8] Naturally Hydraulic Lime

Surface treatments

The evidence for previous surface treatments at the Minster has already been noted in Chapter 3 and it is possible to observe many of these coatings on the building. Again, the recognition of these treatments is currently based on observation alone and would benefit from detailed scientific analysis to shed further light on the nature and behaviour of these media. Some, such as linseed oil, were applied to protect new stone and preserve the old. Others, including limewash, were intended to protect and refresh the appearance of the stonework. So far, limewashes have only been positively identified on the interior of the East Front, although traces of what appear to be lime-based coatings feature upon the exterior at high-level, and in particularly sheltered zones on the north and south aisles (Figure 151).

Linseed oil (Figure 152): Suspected linseed oil coatings survive in varying states of preservation and impart an orange-brown hue to the treated stone. The stone is invariably darkened, and recent trialling with linseed oil has provided a useful visual index for recognising historic applications (see Chapter 5; Hall 2008, 56-58). The archival evidence discussed in Chapter 3 has already shown with certainty that boiled linseed oil was applied to the stonework of the eastern arm from the 1830s onwards. However, non-location specific references demonstrate that it was in regular use much earlier. Its use as a preservative on the East Front continued throughout the first half of the twentieth century before being dispensed with by the 1960s. Current guidance on the conservation of stone and floor tiles has identified the problems resulting from the use of linseed oil as a protective medium (Ashurst 1994b, 230-235; Stewart et al 2008, 152). Chemical, physical and petrological analysis has shown that the oil can reduce the permeability of treated stone, often enhanced further by its ability to attract soiling. This can lead to the crystallisation of trapped salts and subsequent decay. The presence of oil can also contribute to physical differences across the surface of the stone, particularly as the depth of penetration is often inconsistent. Again, this may

result in the scaling and exfoliation of the surface and the loss of primary material.

East window mineral paint (Figure 153): Parts of the Great East Window were painted with a grey-green mineral paint during Feilden's tenure to conceal atmospheric staining and to consolidate decay. This paint was mainly applied to the undersides of the arches of the lancets and tracery lights. This paint generally fulfils the aim of its application. However, it is likely that this less-breathable treatment may have deflected and maintained the decay mechanism beneath, with salt crystallisation ongoing on the interior face of the stonework.

Interior limewashes (Figure 154): Despite sustained rounds of cleaning the interior of the Minster, evidence for coloured and plain limewashes still exists in hard-to-clean facets of the masonry. Such finishes also remain at high-level where thorough scrubbing was deemed less necessary. The most recent general limewashing operation took place during Feilden's cleaning programme in the early 1970s. This coating survives in overall good condition and is white-grey in appearance. On the interior of the East Front it is used on and around the east window arch and tracery. It overlays a number of previous lime-based washes and, on the window, linseed oil treatments. These earlier limewashes may represent the remnants of any number of refurbishment programmes. These include the 1793 colour-washing, the restoration after the 1829 fire and the cleaning that took place during the 1840s. These earlier coatings are often brown or ochre coloured, perhaps altered by dirt and candle vapour. A pure-white limewash has been noted beneath the colour washes. This may have been applied simply as a primer, or as a finish in its own right at an earlier time (see section 4.4.3 below).

4.3 The archaeology of the East Front

4.3.1 The construction and repair of the façade

This section provides a detailed outline of the archaeology of the East Front and Thoresby's east end and should be read in conjunction with CAD Drawings 1-5

These drawings encompass the main project 'Areas' for the current repair of the facade.

These 'Areas' run as follows:

Area 1: The north clerestory (bays 1 and 2 from the East Front)

Area 2: The buttress south of the Great East Window

Area 3: The buttress north of the Great East Window

Area 4: The central vessel of the East Front, including the Great East Window voussoirs but **not** the Great East Window masonry units

Area 5: The south aisle and turret of the East Front, including the first bay west in the south elevation

Area 6: The north aisle and turret of the East Front, including the first bay west in the north elevation

Area 7: The Great East Window mullions, tracery and jambs

Area 8: The south clerestory (bay 1 from the East Front)

The horizontal divisions of the East Front are also used as points of reference for the gazetteer that follows. To maintain continuity between the current repair specification drawings and the archaeological analysis, the same lettering system has been incorporated for these horizontal divisions (Figure 155). This system divides the exterior façade into Levels A (plinth level) through to I (spirelet level). The foundations are considered part of Level A. Each level description begins on the north side of the building and runs south before moving on to the next, at the same time taking in the interior when necessary. The complex masonry and sculptural programme of the Great East Window is discussed separately in Section 4.4 so as to avoid fragmenting its analysis across Levels A-F.

Level A:

The foundations and setting-out of Thoresby's east end

Parts of the foundations of Thoresby's east end were recorded during the 1960s underpinning operations. In the main this was by photography (Figures 156-160), although the footings of the east wall in the north-east angle of the south buttress were measured and drawn during the evaluation dig in 1968. These surveys are reproduced as Figures 161 and 162. From the outset it is fundamental to note that the foundations were not only shallow in depth and profile, as revealed in the 1960s, but also extremely inconsistent across the site.

The photographs taken in 1969 provide valuable insights into the nature of the foundations of the East Front and Thoresby's east end. Figure 156 shows the foundation of the first buttress west of the north-east turret. A stone coffin was incorporated into the base of these footings, which abut, and were therefore positioned slightly after, the north aisle wall. Three courses of rough masonry rest squarely upon the base with a slight overhang along the western face. The mortar waste from working above appears to have accumulated around the base of the buttress and can be seen in section in the north-west angle.

Beneath the north-aisle wall west of the north-east turret a substantial section of a Roman building was exposed during the initial stages of the engineering operations (Phillips and Heywood 1995a, 25-26; Figure 157). Defined as part of 'Building Four' by Phillips, this masonry must have been encountered by the fourteenth-century builders as it was incorporated *in situ* into the east end foundations. Individual masonry items were also re-cycled into the rubble footings of the East Front on the southern side. Figure 158 shows the foundations of the north-east turret. Here the east wall rests upon four neat courses of masonry which run cleanly from the north to east faces. These courses rest upon a stone coffin, its lid skewed to the north and bedded on a thick layer of mortar. Beneath the north face further ex-grave material appears to have been reused. Above foundation level, the adjustment of the main plinth mouldings can be seen in the north east angle.

Figures 161 and 162 present the results of the evaluation dig undertaken in 1968 in the north-east angle of the south buttress. While these excavation records provide only a brief glimpse into the below-ground archaeology of the East Front, they do at least demonstrate the potential complexity of the sequence of events here, which fall well beyond the construction of the East Front. What is clear is that the ground on which the façade was erected was far from virgin. As with the northern foundations outlined above, Figure 161 illustrates that residues of Roman structures had been incorporated into the footings of the south buttress. The base of the east wall appears to have been trench-filled initially, whereby a channel was dug and filled with salvaged eleventh and twelfth-century rubblestone. Courses of re-claimed stone were then built-up above the rubblestone, still within the trench, before newly dressed masonry was laid at ground level to create the 'seen' face of the east wall. Figure 162 shows the toothing-in of the south-buttress masonry into the main east wall, demonstrating that the eastern face of the façade was being constructed slightly ahead of the buttress. This approach appears to have been common throughout the entire construction of the East Front.

Fortunately, an array of masons' marks on the wall and buttress masonry were also recorded during the excavations. Within this group is a distinctive mark that bears close resemblance to another that is repeated along the interior wall-bench and up, into the north-east and south-east stair turrets (Figure 163). This may offer the tentative possibility that the footings, wall-bench and initial stages of the turrets are to some extent contemporary with one another. In turn, this questions Brown's (2003, 158) suggestion that the foundations and eastern plinth had been laid down separately in the late 1340s, some years before Thoresby's campaign had begun. In the creation of the foundations at the south-east angle of the East Front it appears that the builders encountered less in the way of pre-existing structures or grave material (Figure 159). When compared with the foundations at the corresponding angle on the north side, the construction is very different in character and based mainly upon rubble. However, some attempt appears to have been made to provide a solid base to the southern buttressing element of the turret.

Finally, Figure 160 shows the foundation of the first buttress west of the south-east turret. A rubble-filled coffin was reused to create a base for the buttress on the south-east corner and, again, there are differences between the nature of construction here and on the corresponding buttress on the north side seen in Figure 158. The most obvious of these is the off-setting of the buttress masonry upon its footing towards the south, and this discrepancy is key in understanding the sequence in which Thoresby's east end was first laid out, and subsequently constructed (see Figure 96). It suggests that the trench foundations were set-out and created as a piece, and that the building of the superstructure had then proceeded in a clockwise direction from the north aisle to the East Front with the walls (incorporating the interior wall bench) and buttresses set square on the foundations. However, by the time the south aisle was reached the builders must have recognised that the foundations had crept too far to the north, as the decision was taken to re-align the aisle walls on their foundations.

In fact, it appears that this error was recognised during the building of the base of the main east wall and wall-bench. As the plan of the eastern arm in Figure 96 shows, within the north-east angle of the interior of St. Stephen's Chapel the wall-bench is not set parallel to the masonry above, with alignment correction to the north (enhanced by subsequent rotation of the structure) having been implemented above bench level. Within the south-eastern angle of All Saints' Chapel, however, the position of the wall-bench is parallel to the masonry above, and thereafter the south aisle wall continues west with an improved alignment above foundation level.

In plan, the consequences of the initial straying of the foundations from a correct east-west axis manifest themselves in the misalignment between the buttresses, windows, arcading and piers on the north side. Having dictated the position of the buttressing, and therefore the bay-rhythm of the east end at foundation level, the masons were then faced with the task of absorbing the errors accrued from the foundations within the superstructure above to ensure that the interior arrangement remained as sound as possible. Therefore, the solution adopted was to set-out the piers, and general interior of Thoresby's

east end, from the corrected and more reliable south aisle wall. The net result is that the arcades are true to the bay rhythm of the south aisle, but not the north.[9] Moreover, as will be seen, the desire to correct each stage of the East Front to an improved north-south axis, as well as to a true vertical plane, will be observed.

The archaeological analysis of the foundations suggests that the construction process therefore ran as follows: the foundations were set out, beginning with an off-set on the north side for the aisle wall from the twelfth-century choir (itself misaligned). The foundation trench was then cut and filled to completion. The superstructure was then commenced, including the plinth and wall-bench constructed directly upon the foundations, beginning at the west end of north aisle wall. The misalignment of the foundations was only then recognised during the construction of the base of east wall, and the superstructure was subsequently re-aligned at south-east angle to compensate for this. The construction of the base of the south aisle wall continued westwards from here, but was now off-set upon its foundations. Rationally, the next stage in the sequence would have been to set-out the internal scheme above the wall bench using the south aisle wall as a base-line, but only after the full demolition of the old twelfth-century choir had taken place. If Norton and Harrison (forthcoming) are correct in their hypothesis that Archbishop Roger's choir incorporated a corona-like extension that continued into the footprint of the new east end, then the setting out of the new internal space would not have taken place until the clearance of this part of the earlier building.

Much has been made of the shorter, easternmost bays of the east end, including the suggestion that the presence of the parish church of St. Mary ad Valvas (on what is now College Green) had restricted the amount of space to build on (Harvey 1977, 163; Wilson and Mee 1998, 110; Morris pers. comm.; Figure 164). Brown (2003, 144) is rightly sceptical of this, however, citing the demolition of the church in ?1376 as a sign that, had it been an obstacle, its

[9] I am indebted to Professor Christopher Norton here for his guidance during discussions on the setting-out of Thoresby's east end

demolition could have been arranged earlier. As such, the explanation for the short bays may be much simpler, in that the easternmost bays had to accommodate the stair turrets and wall-passages leading to a reduction in the available space for fenestration.

The superstructure

In elevation above foundation level, the exterior plinth accentuates the base of the East Front and its completion is likely have constituted the first main building break of the construction campaign. The interior wall-bench falls within this phase and would have bonded the inner and outer faces if the walls, closing the head of the structure before the winter. This may well have been the winter of 1361, with site preparation and construction having taken place from the laying of the foundation stone in July until the autumn, when building usually ceased.

The form of the plinth differs between the aisles and the east wall, a feature that has been complicated further due to the extent of stone replacement upon the plinth over time, as considered in Chapter 3. Notwithstanding the references to renewals in the seventeenth and eighteenth centuries, a number of stones also bear the characteristics of nineteenth century work (i.e. bolster tooling, 1820s stone types and renewal to a near-vertical plane), along with the more obvious and widespread replacements of the 1970s. Indeed, this round of repairs saw the form of the main drip moulding misinterpreted, leading to an incorrect and misleading representation of the original design of the plinth.[10] Brown (2003) views the differences in the façade and aisle plinth-forms as tentative evidence for a building break between the 1340s and the 1360s, with the east wall having been laid out first. However, these transitions do not occur at obvious points for a building break, being surprisingly obvious across the north-east and south-east angles of the north and south turrets. A discreet and more practical choice would surely have been within the junction between the turrets and the east

[10] I am grateful to John David for information relating to the repair of the plinth in the 1970s.

wall, or, perhaps more likely, the junction between the turrets and the aisle walls. It is difficult to offer a counter-explanation for this phenomenon, but it is possible that the east-front plinth masonry was prepared and stockpiled sometime ahead of construction, before having to be absorbed into the more contemporary design of the plinth of the aisle walls during building. Alternatively, the two plinth-forms could have been designed according to their position on the eastern arm. A more elaborate form could have been reserved for the main façade, with the aisle plinth executed in a more regular design to enhance the sense of uniformity between the eastern arm and nave.

After the initial laying-out of the structure in 1361, construction above plinth level would have resumed in earnest during the years that followed. With Archbishop Roger's eastern termination now being dismantled, any twelfth-century ashlar could be directly recycled into the construction of the East Front above the plinth. The pattern of coursing and angles of tilt within Level A, and beyond, give strong clues as to how building proceeded after the plinth was completed. Within the easternmost bay of the north aisle a sequence of mis-coursing occurs immediately after the westward return of the north turret (Figure 165). Described by Brown (2003, 158) as an area of uneven bonding, this appears to be a toothing joint between the East Front and the north aisle wall. In the corresponding bay on the south side this feature appears to have been virtually obliterated by re-facing undertaken in the 1970s, although a photograph taken at distance of this bay gives the suggestion that a toothing pattern did also occur here (Figure 166). Significantly, the masonry east of the breaks exhibit tilt, while the aisle sections to the west do not. This is therefore a strong indication that the East Front had proceeded as a separate construction from the aisles above plinth level, having settled differentially on the foundations. This confirms that the builders of the East Front were following the constructional convention of carrying up the façade, and especially the corner-work, ahead of the adjacent aisle and arcade masonry so as to effectively receive its thrust (Ayers and Sampson 2000, 15). Intriguingly, the masonry of the plinth on the south side also exhibits some degree of tilt. However, this is more likely to have been induced later-on from ongoing settlement of the

foundations, as the pattern of 1970s stone replacement suggests that the westward masonry had split right through to the ground at some stage.

The main stringcourse above the plain ashlar masonry represents the point of the next building break. Below this level, the stonework is generally coursed with the buttresses at intervals, but does not bond; thereafter, bonding begins at intervals. The degree of tilt is maintained between this stage and the first tier of niches, however, suggesting that little time had elapsed between each phase. Indeed, close examination of the interior wall passages shows that construction still centred upon re-using stone from the old choir, and perhaps the old palace at Sherburn-in-Elemet, with only bespoke elements (such as mouldings, details etc.) being worked new. This appears to have been the attitude towards erecting the interior of the east end generally. On the exterior, the clear change in block size just beneath the stringcourse on the south buttress through to the east face of the south aisle may be indicative of a break just below the string, although it is just as likely that the supply of re-used twelfth-century blocks had simply stalled at this point, or that the builders had found it necessary to level-up the work using freshly cut stone. On the north buttress and turret a series of larger blocks were also introduced, perhaps representing an attempt to bond the masonry back into the middle third of the buttressing in the hope of restricting movement. The 'stitching' of the main east wall at this level under the auspices of Sir Bernard Feilden is also plain to see, showing that the fears of the original builders were justified. Ultimately, the re-use of smaller stones in a structure far grander in size than the one they had originally been procured for may have in itself introduced an inherent issue of instability. The inevitable higher ratio of mortar joints-to-stone, coupled with the apparent lack of substantial bonding between the outer and inner skins of masonry, may have rendered the base of the structure unduly flexible.

Above the stringcourse the first tier of faceted niches were introduced for the display of statuary. From a practical standpoint, these also presented an opportunity to reduce the masonry loading of the leaning buttresses. The closing of the wall-head with the stringcourses also provided a chance to review

the state of the structure in plan, and, if necessary, to adjust the north-south alignment of the eastward face of the East Front. This is particularly apparent within the angle of the north turret and east wall, where a clear attempt was made to re-adjust the lean and axis of the façade. On the north and south sides of the corner turrets round to the East Front there is an intermediate construction break, indicating that an even horizon taking in the sill and stooling levels of the façade windows, and the frieze of carved heads beneath the Great East Window, was initially being worked to a point beyond the stringcourse. Thereafter, the masonry taking in the niches up to the level of the springing-level of the eastern windows of the aisles was worked to, representing the final component of Level A. This building horizon may in fact be a high-water mark in the construction, since the complexity of the masonry increases after this point and changes in the management of the workforce are strongly evident thereafter. The masons' marks of the interior wall bench are common to those of the stair turrets, and remain consistent up to the level of the turret weathering, parallel with the window capitals (Figure 163). However, this pattern of marks ceases at a narrow bonding course at the level of the capitals, after which no masons' marks are observed within the turrets. This is at least indicative of a change from piece-workers to waged masons, but may also tentatively represent an overhaul of the workforce if their competency had been brought into question as a result of the outward lean of the façade.

The east windows of the aisles overlap Levels A and B (Figures 167-178). They bear deeply moulded jambs and arches, and there is evidence of substantial renewal over time, especially on the north side. The north window has been largely refaced or renewed to full-depth in 1930s Clipsham stone. Some original masonry still survives within the mullions and tracery, however, and at least two phases of mortar and OPC cement patching have taken place. The outer hood-moulding of the north window appears to have been renewed in Huddleston stone, and may therefore fall within the remit of the 1840s and 50s repairs. The carved labels may also be restorations. Inspection of the interior window masonry and adjacent walls and vault within St. Stephen's chapel has also revealed that a significant amount of the interior of the structure was

restored inside (Figures 179-181). This refurbishment was undertaken in Huddleston stone, where a clear distinction between the primary and replacement masonry can be marked by the fact that the earlier stonework is pink as a result of burning and there are distinct variations in capital design. Both ashlars and moulded stonework, including a number of the vault ribs, were replaced into the second bay to the west and the eastern respond of the main arcade was completely refaced.

A separate sequence of late-medieval masons' marks can be associated with the Huddleston stonework and the dragged finish of this masonry is much finer (Figure 182). Importantly, the hypothesis is that this is evidence of the fire, and the subsequent necessary repair, that supposedly took place in the Minster in 1464.[11] Should this be the case, then the fire may well have contributed to the structural problems that continued to develop within this zone of the East Front, facilitated by the weakening of the burnt stone followed by its removal and subsequent replacement. Interestingly, an array of vertical cracks can still be seen through the walls of the chapel and the 1934 Clipsham renewals to the east wall appear to have been introduced as a response to this problem. Eventually, the cracks were afforded more substantial 'stitching' on the exterior during the 1970s engineering works.

Most of the eastern window of the south aisle is original fourteenth-century work, except for some minor indents and re-facings in the early nineteenth and twentieth centuries in Tadcaster and New Ketton limestone respectively. In addition to the renewals are three phases of mortar repairs across the mullions and tracery. These range from the typically coarse, lime-based repairs (especially upon the mullions) through to cementitious and OPC types higher up. Again, like its northern counterpart, the hoodmould within Level B has been

[11] I thank Professor Norton for sharing his thoughts on the fire of 1464, and for the suggestion that the aisle window design on the tracing floor above the Chapter House vestibule may in fact relate to the renewal of the window rather than for its original design. The surviving capitals of the window mullions are original 1360s work in Tadcaster stone and are pinked from burning. The tracery above however (which also includes twentieth century Clipsham repairs) is in Huddleston stone with medieval tooling, but without any evidence of burning.

renewed. On this window, however, an original headstop remains on the south side. It also appears that the arch has separated at its apex at some point, requiring packing-out with slate, perhaps when the hoodmould was repaired. These symptoms of movement indicate a north-south separation of the masonry caused by differential settlement between the south turret and the south buttress, owing to the insubstantial foundations already noted at the south-east corner.

The large turret and buttress niches of Level A, of which two are known to have once held statues, are generally in a good state of preservation (Figures 183-190). Furthermore they have seen comparatively little renewal over time when compared to the areas that follow higher up. That said, the northernmost has still seen three phases of stone replacement, with the pedestal, mouldings and canopy dating from the 1850s, early 1900s, and 1970s. The holes for the fixings for the statue of Vavasour survive at the rear of this niche (Figure 191). The north-buttress niche has seen its grotesques, canopy and upper string and mouldings renewed within the same periods, along with the head and table of the carved pedestal. On the south buttress, the extent of repair to the niche is relatively modest, with few indents. Coarse, lime mortar repairs survive within the canopy, and could date from any point up until the use of cements in the later nineteenth century. The canopies also bear an artificial orange-brown hue, perhaps indicative of treatment with linseed oil, and the delicate fourteenth-century cusp-carvings are showing signs of surface decay through scaling (Figure 186). Within the rear face of the south-buttress niche the re-setting of a block in lime mortar gauged with brick dust is evident, along with a small zone of pinking through burning. Together, these features may be a sign of statue fixings having been removed, with the burning caused by the melting of lead used to seal ironwork. Therefore, it is conceivable that a statue of also stood here, accompanying Vavasour to the north and Percy to the south.

To the south, the Percy niche still bears strong evidence of the identity of its occupier (Figures 193-195). The niche is largely intact, save for twentieth century Clipsham and Cadeby indents and some lime-mortar repairs within its

head. The remains of a Percy helm survive above, complete with the hind quarters of a lion. That the helm is pinned-in with tile suggests that it is an insertion, and that at the time of construction the identities of the occupying statues had not yet been designated. The iron fixings for the statue, bedded in lead, also exist within the rear of the niche and upon the northern jamb. Adjacent to the niche to the south, the turret window has been renewed in Clipsham, with an earlier nineteenth-century carved spandrel having been retained (Figure 196).

Within the central vessel of the exterior, the Great East Window is also immediately flanked by niches at Level A (Figures 197-202). These niches are both in good condition, having had their canopies and sections of their bases renewed in magnesian limestone sourced from Tadcaster, most probably during the tenure of William Shout. Beneath the sill of the window runs the frieze of seventeen carved heads (Figure 203). These are afforded closer discussion in section 4.4 which deals with the Great East Window and sculptural programme in greater depth. Here, however, it is worth noting that the northern and southern extents of the frieze are bonded with the buttresses, therefore demonstrating that the carvings were an original element of the design (Figures 204-205). As indicated by the archival evidence, these carvings were indeed substantially restored in Ketton oolitic limestone during the 1915 repairs.

Level B

Level B takes in the niches of the buttresses and Great East Window, as well as the heads of the aisle windows and the first tier of panelling on the eastern faces of the corner turrets. The level of ornament at this stage increases, and it is perhaps no coincidence that from here through the remaining levels of the facade that the nature and extent of the previous restorations intensifies.

Along the north and south sides of the corner turrets the constructional relationship between the aisle walls and the East Front is made apparent. On both sides there are straight joints between the voussoirs of the arches of the

aisle windows and the turret masonry, which suggest that the turret would have been built up before the arch was constructed against it. That the turrets continued to be built to just below the level of the stringcourse, in advance of the aisle walls, is borne out by the presence of mis-coursings and tilt-angle differences between the stonework of the turret and the masonry above the aisle windows. The carved cornices of lions' heads and foliage also stop abruptly against the turret (Figures 206-208). Once the turrets were complete, they were ready to buttress the aisle walls, before the two sections were eventually linked by the stringcoursing. The focus of historic renewal in these zones seems to have centred on the hoodmoulds of the aisle windows and the weathering and parapets above (Figures 209 and 210). In addition, on the south side the carved cornice appears to have been fully replaced, with the Tadcaster stone-type suggesting that this was during the time of William Shout. There are also traces of previous surface treatments in both zones, including pigmented limewashes and staining from treatment with linseed oil.

Moving round to the East Front proper, the eastern faces of the turrets are finished with faceting and mouldings (Figures 211 and 212). Again, this is employed to both aesthetic and practical effect, adding verticality to the turrets whilst also reducing their structural footprint, and therefore their mass. These areas were also repaired in the nineteenth and twentieth-centuries, with particular attention having been paid to the mouldings. At the head of the mouldings on the north side, the limit of the 1850s rebuilding becomes clear, with the whole of the turret having been dismantled and reinstated down to this level. Over the aisle east-window is an area of plain masonry that, owing to its inconsistency in bed-height, is likely to incorporate re-used material. If so, then this may originate from the lowest stages of the old choir as it was dismantled towards the end of this stage of the East Front's construction. After the erection of the arches, the masonry of the turrets seems to have been carried up in stages, with the spandrels filled in at intervals to the next stringcourse level.

The final section of Level B incorporates the buttresses and niches of the Great East Window (Figures 213-221). Though both were substantially restored in the nineteenth and twentieth centuries, the buttresses maintain the degree of lean from the levels below. This indicates two things: a) that the original builders were not consciously responding to the outward lean at this stage, suggesting that it had either not yet fully manifested or was not viewed as a problem; and b) that during the nineteenth and twentieth centuries, the masons were content to rebuild to an eccentric vertical plane. The pattern of coursing and bonding, or lack thereof, between the buttresses and main east wall sheds light on the approach to construction as the façade progressed. It seems that the main east-wall masonry was being erected slightly ahead of the buttressing, with the buttress masonry then coursing and bonding at intervals on the east window-niche sides and predominantly coursing but not bonding on the aisle sides. After a run of straight-jointing, the first bonding point occurs within the top courses of the niche columns, implying that this level was a momentary building horizon before completion to the next stringcourse. The decorative elements of the niches are almost entirely restorations on both the north and south sides, and bear evidence of previous attempts at consolidation with linseed oil (Figure 221). Only the innermost southern column of the north buttress appears to be an intact fourteenth-century original (Figure 219).

Level C

Level C represents a key moment in the construction of the East Front and Thoresby's east end. It is by now that the main arches and triforia of the arcade were introduced and completed, and where further adjustments to the design were made. This appears to have led to a degree of stabilisation, intended or otherwise, although it appears that the structural problems were yet to be fully arrested.

At Level C the corner turrets were continued ahead of the upper masonry of the eastern terminations of the aisles. Here, the stonework is faceted with cusped niches to reduce the thickness of the walls (Figures 222-223). Between the

turrets and the upper aisle masonry on the eastern face there is a degree of adjustment in weathering design. This had to be adopted to absorb the levels that had been established slightly separately above the aisles with those of the East Front proper. This is most noticeable on the southern side, with the adjustment taking place within the angle between the turret and the adjacent wall masonry (Figure 224). It here that the two sections were closed, resulting in the mis-coursing of the weatherings and, perhaps, a 'fudging' of the cusped stonework above. The treatment of the cusped stonework remains slightly speculative because of the extensive degree of renewal that has taken place on both turrets. On the south side the condition of the stonework coupled with the tightness of the joints indicates that it was almost entirely re-constructed in the 1820s or 1830s, taking in Levels D and upwards above. On the north, the situation is almost identical, except that the stone is Huddleston and therefore part of the 1850s repairs. There is no evidence in the archives as to why these sections required such extensive work in the nineteenth century. However, inspection of the interior stair-wells sheds valuable light on why the restorations were in fact very necessary. Internally, the south turret has been almost totally rebuilt down to the level of the aisle parapet, including the top seven steps of the newel stair. Only the lower, westernmost courses of fourteenth-century work remain *in situ*. Below the rebuild is an array of large vertical cracks within the stonework, which has been pointed-up on at least two occasions. It is highly likely that these cracks originally carried on into the upper levels of the turret and that a stage had been reached where the structural stability of the turret was in doubt. The situation is very similar on the north side, except that reconstruction appears to have taken in more of the eastern termination of the aisle. These episodes of large-scale re-construction further reinforce questions about the effectiveness of the foundations of the East Front. Not only did they allow the façade to lean through a lack of sufficient depth and toe, but their inconsistency also led to differential settlement and failure within and between the corner turrets.

Within the central elements of Level C, the buttresses have pairs of deeply recessed niches on each face, with foiled pedestals over beasts forming the

niche-base and vaulted canopies above (Figures 225-234). Analysis of the geology shows the carved and moulded components are largely nineteenth-century work of the 1820s and 1840s, save for an original pedestal on the south face of the south buttress (Figure 227). Taken as a motif, these pedestals are repeated in a smaller form as part of the statue-supports in the Lady-Chapel aisles (Figure 235). This, coupled with further structural evidence outlined below, indicates that the arcades and these levels of the buttressing are likely to have been conceived at about the same time. This is likely to have been by 1365 when the documentary evidence records the clearance of the old chantries during the preceding year. The core and plainer masonry elements of the buttresses at this height, including the points where they engage with the main façade, are fourteenth-century work. The coursing pattern is therefore still retained, and reflects a distinct upward run of mis-coursing above pedestal level within the westernmost niches of both buttresses, adjacent to the façade. Here it appears that the stonework of the façade, including the interior face, was carried up to stringcourse level with the exception of the buttresses. This would have formed a column of masonry to which the inner arcade, outer buttressing and outer aisle-top masonry could be added. Additionally, this would have facilitated a short pause in the buttress construction, giving the masonry below time to consolidate without immediate over-loading.

That such an approach to building was adopted is confirmed by inspection of the junctions between the triforia and the East Front and the aisle roof-spaces. Inside, the wall passages abut the East Front (instead of passing into it), while in the aisle roofs courses of toothed masonry feature within the angles of the arcade terminations (Figures 236-238). Outside, the upper string courses of the buttresses does not continue round into the adjacent string of the aisles parapets. This suggests that there was a conflict in the design of the upper aisles and the central façade. With the connection of the East Front to the arcade it is possible that the main wall was now provided with a degree of solidity. By now, however, it was now out of plumb by some distance and more elaborate measures to provide greater stability would be required at the next level.

As with the buttress niches, the upper masonry of the eastern terminations of the aisles was afforded deeper faceting at this stage to reduce the loading at the face of the East Front whilst still retaining structural footprint within the middle third of the elevation. Observation of the western faces of these areas within the interior roof-spaces shows the adjustment of the masonry more clearly, with clear off-setting from the fabric below (Figure 239). As noted above, the presence of nineteenth-century stone types shows that there has been extensive replacement of stone work on both the north and south sides, and especially on the north side. Within the primary fabric of these areas the coursing is rather irregular. This could indicate the continued use of larger twelfth-century stones from the base of the old choir. Indeed, the interior faces include a substantial amount of re-used material, including small blocks of millstone grit. These sandstones may ultimately derive from the Roman buildings on the site, being re-absorbed into the fabric of the cathedral since the eleventh century (Phillips 1985, 182).

Level D

It was probably only at Level D that the masons had the first genuine opportunity to assess, and react to, the progress and state of the construction thus far. The lower levels of the stonework of Thoresby's east end were now more or less complete, save for the upper stages of the corner turrets and the aisle parapets (Figures 240-246). These must have been added many years after the structural completion of Thoresby's east end, and certainly by 1420, when the aisle vaults were introduced in stone (Brown 2003, 149). Both of the turret-tops are essentially nineteenth-century rebuilds, where the south is in Tadcaster stone (or perhaps Roche Abbey?) and the north Huddleston. However, they remain faithful in their representation of a more mature approach to Perpendicular and ally closely with the design of the aisle pinnacles erected during the vaulting programme (Figure 247). The delay in completing the turrets may have been consciously introduced by the masons to allow the leaning and sinking corners to stabilise, once again reducing the risk of premature loading. The archival evidence indicates that the north and south-

aisle parapets were repeatedly restored, and this is reflected by the geological evidence which shows that the current examples are a composition of nineteenth and twentieth century work. The historic discrepancy in design between the north and south gablets is not easily explained. However, the remnants of disused stoolings on the western face of the south aisle parapet suggest that a superimposed arrangement of gablets had once been anticipated, and perhaps even executed (John David pers. comm; Figure 242). Indeed, Britton's 1819 engraving of the interior of the East Front shows the western face of the south aisle parapet as an order of large gablets, which may have once sat behind an order of seven as has survived on the north side (Figure 18). Gradually, it seems, this arrangement was not sustained, leaving the mismatch that exists today.

With the completion of the angle turrets still a long way off, attention was now focused on the clerestory and upper levels of the main façade, as well as the Great East Window. The innovative design of the clerestory reflects both an increased confidence in the masons' ability to design, as well as a reaction to the structural problems that had developed during building. While the external screenwork of the clerestory bays is somewhat quirky and obtrusive, the benefit to the interior, rendered almost completely flush, is striking (Brown 2003, 148). Moreover, the high degree of piercing and modelling of the clerestory levels represents a clear attempt to relieve the structure of solid masonry wherever possible. As time has shown, the tendency for the façade to lean further was not entirely eliminated by these measures, yet it is likely that more serious problems could have ensued had the masons not reacted in the way that they did. That problems such as movement and structural cracking between the clerestory and the East Front were to develop in the years that followed is a sure sign that, if the loading had been any greater, the thrust from the aisles may have been enough to lead to serious damage, including collapse.

The key question asked by architectural historians is whether or not the changes in the design that took place within the upper stages of the façade and clerestory are representative of a change in master mason (Harvey 1977, 163,

165; Brown 2003, 161-162). The documented change in personnel from Hoton to Patryngton in 1369 has provided scholars with a convenient date and explanation for changes in the fabric design. Brown (2003, 162) has suggested that everything above the capital-level of the Great East Window, including the clerestory, might be attributed to Patryngton, and that the transition from plain screenwork in the easternmost bays of the clerestory to pierced forms in the remainder of the architecture are evidence of this. However, close analysis of the fabric from a constructional and structural perspective before and during the current repair programme suggests that the explanation is not quite so straightforward. While the difference in the form of the screenwork, coupled with the abrupt moulding-change at the springing point of the Great East Window represent obvious anomalies, the build is otherwise generally coherent up to Level E, when the design for the central buttresses was modified for structural reasons (discussed further below). The masonry of the clerestory runs through into the stair turrets, and there is no change in the design of the mouldings across the jamb and springing-point levels of the Great East Window. As Figure 248 illustrates, there is a general consistency in the language of the mouldings of the East Front between the lower and upper levels of the façade. Importantly, the moulding form of the shallow spandrel niches around and above the window arch is a continuation of the outer mouldings of the jambs of the east window below. It is not until the casement, mullions and tracery of the Great East Window that the moulding types significantly change. This strongly suggests that the break in design was confined to the casement and glazing masonry of the Great East Window alone. Closer archaeological analysis, especially during the process of dismantling and reinstatement, has therefore been required to further elucidate the complex pattern of the architecture at this level.

Beginning at the easternmost bay of the north clerestory (Area 1), the renewal of the blind spandrels and mullions of the outer screenwork in 2006 enabled an examination of the sequence of past interventions in this zone. The existing spandrels and mullions were predominantly of Huddleston stone, locating them firmly within the works specified by Sydney Smirke in the 1840s and 1850s,

with the spandrels cut into the jambs by means of straight joints. However, pictorial evidence shows that a blind bay had been included on both sides of the clerestory at a much earlier date (Figure 249). The dismantling of the spandrels revealed that the fourteenth-century through-stone behind was originally cusped, and was therefore intended to bond through to pierced screenwork of a similar form to that of the bays running west (Figures 250-252). On the inner face of the clerestory, close inspection of the 'Great crack' observed by Carr in the 1770s (and again by the surveyor in the 1950s) showed it to be an ancient problem, with attempts at repair spanning several centuries. The spandrel and window masonry had separated, with the void subsequently packed with slips of stone bearing clawed-axe tooling, highly indicative of medieval work (Figure 253). Subsequently, the crack had continued to separate higher up, leading to the opening and dropping of the cavetto corbelling. This had necessitated further packing with bricks and mortar, and later Ketton stone fragments and cement. In short, there was a long history of failure in this bay which had led to a change in design of the screenwork for structural rather than stylistic reasons which may well have taken place within the medieval period.

The pattern of construction and reconstruction is mirrored on the south clerestory, showing that the response of the masons had been introduced on both sides, prior to renewal in the 1830s after the fire. The blind spandrels would have introduced greater stiffness to the masonry in these end bays, providing an enhanced resistance to movement than may otherwise have been the case. Indeed, the structural problems of the easternmost bays are likely to have extended into the run of ashlar work between the clerestory and the East Front buttresses (Level G). The frequent mis-coursing and changes in tilt angles of the ashlar shows that a considerable amount of re-setting, and perhaps even medieval renewal, has taken place in these areas. Remnants of cracking through the door-head and lowest courses of masonry are apparent on the southern side at Level D, with the cracks having potentially extended much further through the work prior to repair. That the design was prone to weakness here may have also reinforced the desirability for the shorter bay at this point.

Moving eastward to the central buttresses, the theme of the niches remains the same as those below, with a pedestal forming the base and a vaulted canopy above (Figures 254-264). However, the niches are more deeply recessed here to again facilitate a reduction in load, and the detailing of the niches is enhanced. On both the north and south buttresses the shaft-mouldings and niches have been heavily restored at this level, indicated by the presence of nineteenth and twentieth century stone types. Only the easternmost pedestal of the north face of the south buttress survives as an original example of decorative work (Figure 255). Recent cleaning of this work has revealed that the original fourteenth-century carving was enriched with foliage, whereas the adjacent 1820s replacements were over-simplified (Figure 256). There is also notable variation in the design and detailing of the niche-heads between the north and south buttresses, a feature also reflected more generally in the work of the original masons within the interior (Figures 265-268). Finally, on the north and east faces of the south buttress, areas formerly affected by decay have been successfully consolidated with lime mortar repairs. These repairs are relatively crude, and the fact that they are very similar in character to the pointing and bedding mix used for the adjacent renewals suggests that they date from the 1820s.

Irrespective of the extent of replacement on both buttresses at this level, the pattern of building was nonetheless retained by the post-medieval masons. The buttresses were built against the main east wall on the inner faces before returning to bond through to the ashlar on the clerestory sides. Crucially, it is at this level that a concerted effort was made to correct the eastward inclination of the façade, with the buttress masonry built to a renewed vertical plane. This is also reflected in the masonry of the central vessel above the springing point of the Great East Window. Here, the coursing patterns show that the construction of the internal arch of the Great East Window began first (minus the casement) followed by the outer masonry units incorporating the large pedestals. These pedestals probably acted as through-stones to bond the work, and are likely to rebate some way into the wall. These outer units would have formed suppressive buttressing at the base of the arch as building continued upwards,

an approach employed in major masonry construction into the twentieth century (Figure 269). On the north side the pedestal is most likely a renewal of the 1820s, while on the south side the medieval work remains (Figures 270 and 271). Interestingly, this pedestal bears evidence of *in situ* repairs. Previous pockets of decay to the rear of the pedestal have been filled with indents, with smaller areas successfully patched and remodelled with lime mortar repairs. Above the level of the pedestals, stretches of vertical mis-coursing either side of the east window suggest that the arch was built separately from the clerestory terminations and buttressing throughout the subsequent levels, before the filling-in of the modelled spandrels between, up to the base of the central parapet.

Levels E-I

Within Area 2, the current programme of dismantling, rebuilding and renewal through Levels E-I has revealed that these sections are some of the most complex areas of the façade to understand. It is because of this complexity that these levels are therefore discussed as a group. Levels E-I incorporate the areas of plain masonry on the sides and rear faces of the turrets of the central buttresses (Level G), the final two stages of the modelled faces of each buttress (Levels E and F), the decorative coronas (Level H) and the spirelets (Level I). The central parapet and pinnacle of the façade also falls within these levels and is likely to have been erected some time after the façade was structurally complete. These areas, and in particular the buttress turrets, have seen substantial renewal in the post-medieval period. However, the core elements of the masonry remain largely intact, and the evolution of the primary elements of the design can be carefully un-picked to reveal the construction and repair history. In general, analysis of the construction methods, geology and tooling of the final stages of south buttress shows that the policy of the early nineteenth century masons was to essentially re-clad the areas of decay and/or fire damage with shallow indents. Although perhaps not the most structurally sound solution, this was clearly the most pragmatic response in light of the extent of stonework that required renewal. At these levels, replacement of damaged

stonework connected with the 1829 fire appears to have been confined to the clerestory cornices, the western faces of the turrets at Level G, and to the western face of the East Front within the roof space (Figures 272-277). Some re-setting of primary fabric of these faces was also necessary during the post-fire work in order to reinstate the stringcourse of the western face of the central parapet.

Beginning with the design of these final levels, the disparity between the ashlar and plain stringcourse sections and the projecting buttress masonries of each turret is quite obvious. The abrupt finish of the corona around the head of Level F to encircle the base of the spirelet (Level I) is also highly noticeable. These clashes in the articulation of the work at high level appear to have been brought about by a sequence of ad-hoc responses to the structural behaviour of the turrets after their initial completion, but still well within the medieval period. This was then followed by cycles of renewal and re-setting in the centuries that followed. New information gathered during the current major repairs to the head of Area 2 combined with the documentary evidence has served to define these responses further. Essentially, this has shown that the turret and spirelet had been constructed to completion before subsequent alteration of the projecting faces of the buttress down to the base of Level E. A sequence of attempts at tilt-correction can be observed, which, alongside the conflicts in design, draw attention to the sequence of construction and alteration.

The first section of ashlars above the level of the clerestory cornice maintain their degree of tilt on both the north and south turrets. These ashlar sections are composed of two skins of masonry with the minimum of core material. The ashlars above the stringcourses are of increased bed-height and bear no tilt. Adjacent to the ashlar units, the buttressing sections (Levels E-F) bear two stages of correction. The first, Level E, corrects from Level D below and is of an unusual form. The main face of the buttresses are set back and enclosed by mullions connected via through-stones. At Level F, however, the buttresses extend fully eastwards again and bear further tilt correction, with the buttress heads connected to the turrets by means of stringcourses and decorative

coronas. Geology and tooling evidence confirms that the extant corona on the south side dates from the 1820s (Figure 278). Its northern counterpart, in Huddleston stone with later introductions in Ketton, was reinstated in the 1840s in the aftermath of the 1829 fire (Figure 279). The turrets are topped by tall spirelets. As described further below, the southern spirelet comprises two phases of rebuild, while the north is mainly fourteenth-century fabric re-capped in Clipsham stone as a result of the gales in the 1950s. By closely following the recent process of dismantling and rebuilding the Area 2 turret, it is possible to understand the architectural pattern even further. Although this new understanding is underpinned by the dismantling of Area 2, certain common superficial features shared by both the north and south buttresses indicate that the construction and repair histories of both are very similar, if not identical.

Commencing with the spirelet of Area 2 (Figures 280-281), this was first thought to have only been re-capped in the 1830s, with the majority of the lower masonry assumed to be primary fabric. However, inspection of the stone types used in the spirelet alongside tooling patterns have since revealed that the central section is composed of Huddleston stone of good quality bearing broad bolster tooling. As such, it is perhaps reasonable to associate this with the rebuilding of 'the large south-east pinnacle' after the lightning strike in 1745. The spirelet was re-built upon the original fourteenth century broach stones, which rest upon the inner skin of the turret (Figure 282). Tilt correction was employed using pads of oyster shells within the eastern face of the spirelet to subtly increase the joint widths on the front face, bringing it closer to plumb. Importantly, this shows that the broach and inner-skin and stair-well of the turret exhibited a certain degree of tilt, despite the correction of the exterior ashlars below the corona, and that it had remained undisturbed at the point of re-building the spirelet in the eighteenth century. This was further reinforced during the stripping away of the corrected exterior skin of Level G, which revealed that the primary fabric of this level had at some stage been re-clad plumb, again leaving the broach units *in situ* and the inner skin intact (Figure 283). This may have been undertaken for structural reasons, as an array of historic vertical cracks running through the interior skin were exposed that had

not been reflected on the exterior. Exactly when this re-cladding operation took place is unclear, however, although it must have occurred long before the extensive repairs to the buttress in the 1820s. Upon removal, the nineteenth-century stringcourse renewals were found to be merely indents against original masonry, and some were galleted-in against the ashlars of Level G with slate (Figure 284). The beds of the Level G ashlars were also finished with broad claw-tool strokes, and the creamy mortar used in the reconstruction of the outer face was of a differing character to the whiter mortar and grout-runs associated with the renewal of the steps within. These steps had been repaired in two phases. Judging by the use of softer beds of Tadcaster magnesian limestone, the first phase probably took place within the 1820s or 30s, followed by Ketton renewals higher-up around 1900 (Figure 285). Both had been achieved by simply cutting out and reinstating without the need to dismantle the turret. This indenting would have been the most obvious and expedient solution at the time, although in the long term is less likely to have been the best structural solution. Like the stringcourses, the steps performed an important engineering function by passing across the two skins of masonry at intervals, thereby frequently bonding the skins of ashlar together. However, when the steps were cut out for renewal their outside ends were left *in situ* to function as ashlars, leading to a lack of bond between the two skins (Figure 286). The consequence has been a gradual erosion of the structural performance of the stair-well as a spine to the turret, leading to greater efforts in the present to reinstate stability.

The dismantling of the corona from around the broach stones revealed key information that underpins the understanding of the evolution of the design of Levels E, F and H of the buttress. Prior to dismantling, it was already assumed that the decision to include the coronas constituted an adjustment of the original design. The surviving fourteenth-century portions of the stringcourses of both Areas 2 and 3 show that the stoolings for the corona had to be cut-in and built-up with mortar or small indents (Figures 287 and 288). The surmounting corona stones also abut the broach by means of straight-joints (Figure 289). However, the removal of the corona from Area 2 has illustrated that this is not

simply the result of restorations. Rather, these straight-joints are in fact a much earlier detail emanating from medieval changes in design which, unfortunately, explain the cuboidal deterioration of the masonry through the upper sections of Level G owing to prolonged water penetration. On fully exposing the broach of Area 2 the original intention for the lower sections of these units to be seen was realised. The addition of the corona had concealed the chamfered bases to the crocketed ribs that articulate the spirelet, with many of the bases having been hacked back to accept the surrounding masonry (Figures 290 and 291). That the chamfers showed little sign of weathering strongly suggests that the foot of the broach had not been exposed for long before the corona was added.

Final clues as to why the decision to abruptly finish the turrets with coronas lay in the archaeology of buttress Levels E and F (Figures 292-302). The masonry of Level F on both buttresses abuts the turrets by means of straight joints, which also run through to the Level E sections. The remnants of primary fabric in the buttresses also demonstrate a strong disparity between the bed-heights of the buttress masonry and the turrets, which was sustained by the subsequent restorations. Within Area 2, the dismantling of Level F has revealed that the nineteenth century masons had simply re-clad their new work onto an intact fourteenth century core which incorporated Huddleston stone (Figure 296). Only the top two courses of Level F had been fully dismantled in the past. This was confirmed by the core material, which included substantial fragments of an earlier version of the corona (Figure 297). The tooling on these fragments closely aligned with the broad bolster work on the central section of the spire, indicating the likelihood that this older corona was part of the reinstatement work following the lightning strike of 1745.

The removal of the outer masonry of Level F revealed a core composed of rubble and mortar interspersed with solid masonry that would have provided extra bond through the work, as well as back into the turret. Many of the earlier restoration stones had been connected to the core by means of iron cramps set within lead (Figure 298). That the form of the turret masonry was interrupted by the buttressing became slightly clearer as the buttress was dismantled. Into

Level E, the removal of the outer skin of stonework showed that the lowest stages had been wrapped around and into the masonry on the clerestory side, and carried through into straight joints on the northern side. Above these bonded levels straight-joints were introduced, along with the obvious clash between the path of the clerestory cornice and the form of Level E.

In sum, the information gleaned from the archaeological analysis before and during the current repairs of Levels E-I shows that the turrets and spirelets of the central buttresses were first built to completion without a corona. This initial work is likely to have included an alternative form to the faces of the buttresses, which were presumably deemed too insubstantial to resist the continuing eastward lean of the masonry at high level. As a response the buttresses faces were re-modelled. This involved taking down the existing work back to the head of Level D and beginning anew. At Level E, the purpose of the switch to recessed ashlars encircled by mullions represents an initial attempt to reduce the immediate weight at the front of the buttress and therefore the possibility of further eastward movement. Although the load was reduced here, the structural footprint and verticality of the design were nevertheless maintained. A further change in design was introduced at Level F, perhaps because eastward movement of the turret was still seen to be a cause for concern. If so, this would have required an increased level of abutment. Level F was therefore built to full projection, cutting into the ashlars of the turret and up to finish abruptly at the level of the uppermost stringcourse. Finally, in order to connect and unify the horizontal termination of the new buttressing with the extant masonry of the turret the corona scheme was introduced. This required the cutting back and concealment of the chamfered details of the broach. Since Level F was seen to incorporate medieval Huddleston within its core, this is likely to have taken place sometime after 1385. In the many years that followed, cycles of repair ensued, involving the re-cladding of both of the turrets, indenting work to the stringcourses and buttresses and the renewal of the coronas on several occasions. Indeed, if the references highlighted by Willis (1848, 38 n^{w}) referring to renewal at high level in 1479 and 1485 are connected

with the East Front, there is every chance that the new corona to Area 2 is at least the fourth known version to have been erected.

4.4 The Great East Window: its archaeology and sculpture

4.4.1 Overview

'the east window, both for masonry and glazing, has been justly considered as the greatest curiosity in the island'

(Pigot and Co. 1829, 1131)

The Great East Window is a remarkable feat of engineering in stone and without it John Thornton's internationally acclaimed glazing scheme simply would not exist. Scholars have repeatedly attempted to place the masonry operation within the chronology of the eastern arm with greater precision, both to attribute the window frame to a specific designer, and to explore the dialogue between the stone and the glass and their respective patrons (Harvey 1977, 165; French 2003, 2; Brown 2003, 161-162, 218-220; Norton 2007). A thread of continuity has been established between Thoresby and Archbishop Richard Scrope and Bishop Skirlaw of Durham, the continuators of the reconstruction of the eastern arm in the 1390s and early 1400s. Both were linked to the Thoresby household, with Skirlaw having been employed in Thoresby's immediate service as chaplain and secretary in the mid-1350s (Jarratt 2004, 3, 8-9). In 1370 Skirlaw made a donation to the fabric during the construction of Thoresby's east end, before making his significant contribution to the east window glazing fund some years later in the early 1400s (Jarratt 2004, 121-122). As Brown (2003, 219) has suggested, it seems highly likely that Thoresby, a keen theologian and educator, had played an active role in deciding the subject matter of the glazing of the Great East Window. As such, the east window glazing scheme can be conveniently seen as a vision of Archbishop Thoresby that was inherited, refined and completed by his successors in honour of their patron.

In terms of the architecture itself, there is general agreement that the masonry units of the window were installed after the structural completion of the East Front. This is not surprising, since it is common masonry practice to erect the mullions and tracery of a window once the aperture is complete (John David pers. comm.). In some cases, however, added emphasis has been placed on the tracery of the window having been a further departure from the original design (Harvey 1977, 165; French 2003, 2; Brown 2003, 159). Ultimately, the unique form and scale of the window has meant that interpretation and conservation-based research has been confined to the glass itself (e.g. Spooner 2005), and this means that a number of important questions remain. Was the masonry installed during Thoresby's time, only to be devoid of its glazing for some thirty years? Or was the stonework erected much later, leaving a vast empty space in the East Front until the glazing was initiated? If so, did the design of the masonry affect the glazing scheme and vice versa? How much of the window is primary work, and how was it repaired in the past and to what extent? And what of the significance and contribution of the sculptural programme surrounding the window, which, until now has remained largely undocumented? The purpose of this section of Chapter 4 therefore seeks to explore these questions further through a fresh analysis of the archaeology of the Great East Window.

4.4.2 The masonry of the Great East Window

Chapter 3 of this thesis has already drawn attention to the significant degree of intervention and surface treatment that has taken place upon the stonework of the east window since its construction. The purpose of the detailed survey and recording, therefore, is to establish greater definition of these past repairs as a means of understanding the extent and archaeological sequence of the original fabric. Furthermore, as Chapter 5 will show it is also important to study and document these repairs for their own sake. If dateable, they will offer clues as to the rates of any subsequent failure since their application. Moreover, if certain

past repairs have performed well the replication of a method might be deemed appropriate to address similar problems in the present.

Beginning with the archaeology of past intervention, inspection of the east window exterior and interior masonry shows that William Shout had indeed substantially repaired the window in the 1820s. The exterior mullions, stoolings and upper course of the sill are all new work in Tadcaster stone (Figures 303-306). The extent of this renewal runs the full height of the mullions and transoms into the first tier of tracery within Level D. Above this level, the tracery is substantially medieval fabric, again in Tadcaster stone and evidenced by the pattern of increased weathering as well as surface finishes (Figures 307 and 308). However, the tracery does include a number of partial and full-depth nineteenth-century replacement stones (Figures 309 and 310). Some are shallow indents, taking in only the outermost mouldings. Others fall back to the original glazing groove. The partial removal of the foliage details from the transom stones of the tracery elements can also be followed, with the original medieval motifs still strongly represented on the interior (Figures 311 and 312). Of the outer casement, several of the carved voussoirs also appear to be renewals and the moulded orders have seen significant intervention. This includes the wholesale replacement of the hoodmould by Shout, as well as subsequent 1970s replacements (Figure 313).

Inside, the window is linked to an elaborate inner screenwork by means of large through-stones, with the bonding of the two skins completed by the main transom (doubling as a walkway) at the springing level of the east window (Figures 314-318). The creamy-white, slightly crystalline appearance of the stone of the inner screenwork suggests that it was taken from Huddleston, and therefore after 1385. While the screenwork and its wrought-iron reinforcement constitute primary fabric, the through-stones and panelled transom are 1820s work. However, some medieval stonework was re-set within the parapet above the transom. In line with practices at the time, Shout appears to have tackled the repair of the window by leaving the upper tiers of the tracery and inner screenwork *in situ* and removing and reinstating the mullions, main transom

and first tier of work below. Unavoidably, when first built the exterior and interior masonry of the east window had to accommodate the eastward lean of the façade and the intermediate attempts at correction. Shout was content to do the same during repair, with the new mullions mirroring the lean of the interior screenwork and rising out of plumb to meet the tracery above. This operation was an accomplished process of engineering in itself, achieved by supporting the tracery at key nodal points with timber 'needles' that passed through the window between the exterior and interior scaffolds.

Although the interior of the east window is known to have been decayed at the point of John Carr's survey, it is likely that the extensive renewal by Shout was led equally by concerns over its structural stability. Indeed, it appears that a number of Shout's through-stones appear to have partially failed soon after their installation. A number of the stones bear significant cracks that were then cramped together with iron ties (Figure 319). These may have been introduced as early as 1844 when the archival evidence shows that work to the interior of the window was taking place.

Notwithstanding the history of stone replacement upon the window, it is also clear that the tracery and casement have also been maintained by multiple phases of mortar repair. These range from coarse, hair-bound lime and sand mixes from Shout's time (if not before), through Roman Cements reinforced with nails, lime and brick-dust compositions, OPC Ketton mortars and modern sands and cements (Figure 320-322). In general these repairs have survived very well, with few instances of adjacent decay having manifested since their application. However, it is possible that in the cases of some of the cement mortars moisture has been deflected into or retained within the interior face of the window leading to deterioration inside. The evidence for the previous surface treatment of the window also survives on both the exterior and interior. Outside, this includes traces of yellow-ochre limewash and staining from linseed oil, as well as the extensive application of a grey-green silica-based paint in the 1970s. The intention behind this paint was seemingly to conceal decay and blackening caused by sulphation. On the inner face of the window the

mullions, tracery, screenwork and sculpture have all seen applications of surface coatings. Again, it appears that linseed oil was applied to the outer mullions and tracery, followed by limewashing associated with the cleaning of the interior in 1970. Further successive lime treatments feature upon the interior screenwork and sculpture as a legacy of the interior cleaning cycles, including traces of yellow-ochre limewash. These are considered in further detail below.

Assuming the past repairers had generally been faithful to the original form and coursing patterns of the window and adjacent fabric, it is now possible to reconsider the place of the Great East Window and its sculpture within the construction sequence of the East Front. Commencing at sill level, it is clear from the outset that the design of the window and its interior screenwork was a departure from what was originally intended. The screenwork, mullions and tracery share the same moulding profile and were therefore conceived as a unit (Figure 323). However, they do not conform with the mouldings of the main jambs (Figure 324) and the form of the stooling course does not marry well with the jamb bases either (Figure 325). Moreover, the base of the interior screenwork disrupts the head of the stone reredos of the Lady Chapel altar (Figure 326). In spite of the 1840s renewal of stonework in the lower section of the reredos and the insertion of the Victoria-Memorial figures, the upper section appears to be intact medieval work. When viewed from within the sill-level parapet, the screenwork and its foliated cornice can be seen to overlie the reduced projections of the rear face of the reredos.

Continuing upwards, the exterior transoms cut into the window jambs on the exterior and the interior where the screenwork interrupts the jambs and canopies within the window aperture (Figures 327-332). Stone-by-stone recording of the south passage that provides access to the main transom of the window also sheds new light on the nuances of the medieval construction sequence (Figures 333-335), and creates a much closer link between the installation of the masonry and the conception of the iconography of the glass. Initially, the passage steps had passed down to the window at a higher level,

before being modified to extend further down onto the now-lower transom. The purpose of lowering the transom appears to have been to ensure the clear visual division of the main iconographical themes of the glass. These are illustrated in Figure 336, which shows that if the transom had remained at the height as originally intended (reflected by the level of the stair access on the north side[12], Figure 335), the Old Testament scenes would have been forced into the Apocalypse cycle below, undesirably blending the distinct strands within the narrative of the glazing scheme.

As noted above, the exterior sill reliefs were an integral part of the construction of Level A. If it is accepted that the vaulting of the central vessel was underway by 1371, then the interior arch, with its outer order of carved angels and inner orders of busts of kings beneath canopies, must also have been installed within the main building campaign of 1361-c.1373. To return to the construction break at springing point on the exterior, however, it would seem that that the exterior hood mouldings and carved voussoirs belong with the installation of the window units. The casement and voussoir mouldings respect those of the tracery, yet they bear no resemblance to the mouldings of the interior arch (Figure 337). Furthermore, the curve of the exterior voussoirs is matched by the curve of the tracery masonry, but not by the interior arch i.e. the exterior voussoirs and tracery do not fit neatly within the main arch construction (Figure 338). In order to accommodate this discrepancy, the builders filled-in the gap between the exterior voussoirs and interior arch with a thick wedge of mortar. At the exterior springing point on the south side, the arch rests upon an off-set piece of original masonry crudely cut back with a punch (Figure 339). This stone would have once extended outwards much further and is therefore likely to have mimicked the headstop at the corresponding position on the inside. This suggests that an identical arrangement had been anticipated outside, if not actually constructed, prior to the re-designing of the casement some time later. This change forced the mouldings and headstops outwards,

[12] The north passage is currently blocked with rubbish meaning that detailed recording has not been possible here.

creating the abrupt off-set between the arch, window jambs and niches. Although perhaps blurred by Shout's renewal of the outer mouldings of the arch and vertical mouldings of the spandrels, the pattern of coursing also indicates that the outer casement was built into the wall-head of the central vessel after the structural completion of the East Front. Here, the arch masonry cuts into the vertical mouldings, which appear to have been modified in some cases to accept the outer order (Figures 340-342).

In sum, therefore, it appears that the break in construction frequently referred to in previous studies was confined to the outer casement alone, which was installed at the same time as the tracery and mullions and after the constructional completion of Thoresby's east end. As has been noted elsewhere, the installation of the Great East Window glazing may have been purposefully delayed until the masons were sure that the structure had stabilised (AA/RCA/RS/E.1 12Jan06, 1). That the interior screenwork is in Huddleston stone suggests that this was after 1385, with the 1405 contract for the glass providing the inevitable *terminus ante quem.* Fortunately, the stylistic and iconographical study of the sculptural programme that follows is able narrow the date and context of the stonework of the Great East Window somewhat further, with the likelihood that these units were introduced with at least the broad subject matter of the glazing in mind. This is discussed in greater depth in section 4.4.3.

4.4.3 The sculptural reliefs of the Great East Window

Form, arrangement and condition

This section outlines the archaeology of the sculptural reliefs of the East Front and their possible identity and meanings. It should be noted from the outset that Gothic portal sculpture is comparatively rare in England, and for it to surround windows, even rarer (Engel 2007, 122; Geese 2007, 366). Likewise, the representation of Old Testament subjects (which feature amongst the York carvings) is uncommon in Europe after the late-twelfth century (Murray and

Murray 1998, 192). The sculptural reliefs of the East Front and Lady Chapel are therefore extremely important in both a national and international context. As a consequence, close attention is also paid to their condition here as this factor is not only relevant to their interpretation but also their potential treatment in the future. Further discussion on these aspects of the window will continue in Chapter 5.

The referencing sequence for the carved elements

For reference purposes, each of the exterior and interior sculptural reliefs have been assigned their own unique reference number, given below:

EXTERIOR (Figures 343 and 344):

a1-a17 = the carved busts beneath the Great East Window sill running south-north.

b1-b60 = the sculptural surround of the Great East Window arch including the keystone and seated figure (see also Appendices 1 and 2).

INTERIOR (Figure 345):

c1-c30 = the angels under canopies within the outer order of the Great East Window arch.

d1-d16 = the crowned busts under canopies within the soffit of the Great East Window arch.

The exterior carvings – summary of arrangement and condition

The seventeen carved heads

The seventeen carved heads beneath the sill of the Great East Window currently remain largely inaccessible from the scaffolding (Figure 346). Inspection of these carvings has therefore been significantly restricted. However, it has still been possible to identify the extent of renewal in New Ketton stone during the 1916 repairs and to discern the form of the unrestored units. At present, there

is no indication of any surviving eighteenth or nineteenth century carvings. This suggests that if an earlier phase of renewal had indeed taken place, then the stone had succumbed to the agents of decay relatively swiftly to be extensively exchanged for New Ketton stone. These later carvings are well executed and in generally good condition, and it appears that the masons were keen to retain as much of the earlier work wherever possible. Interestingly, all of the New Ketton carvings exhibit a dark orange patina, which is highly suggestive of treatment with linseed oil. The carvings at either end of the frieze are original fourteenth century work. The bust of a crowned figure is still identifiable at a1 (Figure 347). The form remains clear and facial details are intact. At a17 is the damaged form of a mitred figure, where the face and part of the mitre are now lost (Figure 348). Overall, the early busts are in varying states of preservation and exhibit the usual array of decay phenomena – powdering, scaling and loss of surface. This is likely to have developed since the water cleaning programme between 1970-1971, prior to which the reliefs had been encrusted with atmospheric soiling.

The sculptural surround of the east window arch

The sculptural surround of the Great East Window comprises the order of carved voussoirs (b1-b58) adjacent to the tracery (Figures 349-353), the 'Green Man' keystone (b59) above (Figure 354) and the seated figure within the apex niche (b60, Figure 355). Record photographs and condition maps of these carvings can be found in Appendices 1 and 2.

In total there are fifty-eight voussoirs which can be divided into the following basic subjects:

ten lions' heads

ten sprays of foliage

eighteen seated figures

eighteen canopies

one seated Virgin

one seated Christ

From the springing of the arch the carvings ascend in the order of lion, figure, canopy; foliage, figure, canopy; lion, figure, canopy and so on. This arrangement is mirrored north and south. The final two voussoirs at the apex are the Virgin on the south side and Christ on the north (Figure 356). The majority of these carvings appear to be fourteenth century originals, with up to six having been replaced at some stage. Above the Virgin and Christ within the hood-mould is a Green Man, the product of the restoration by Sam Monk in 1915. The keystone comprises two stones, the right being an original fourteenth century stone and the left a renewal in New Ketton. The two stones are aesthetically unified with an accomplished mortar repair.

The voussoirs are in varying states of preservation. Those immediately above the springing point of the east window are in a poor condition, with substantial loss of detail caused by exfoliation and peeling away of case-hardened surface skins, blistering, powdering and scaling (Figure 357). This may, in part, be driven by the presence of the strong ledge between the capitals of the east window jambs and the arch. This ledge may represent a point at which water can collect during rainfall, before 'wicking' up the arch and voussoirs through capillary action. Any moisture carried through these stones will no doubt mobilise salts, which are the primary contributor to the ongoing deterioration of the carvings as a result of wetting and drying cycles. In addition, the voussoirs face outwards at this level before progressively turning inwards as the arch rises. This means that the lower carvings have been more exposed to wind-drying, which is known to cause salts to crystallise rapidly and prematurely beneath the surface of the stone (Eric Doehne pers. comm.). Many of the details of the carvings bear micro-cracks, and the majority exhibit calcite faults. These faults are mostly benign, although there are instances where details have sheared away through loss of cohesion between the magnesian limestone matrix and the calcite plane. In some cases these faults also evolve as 'hard-spots'. These lines can promote preferential weathering and sulphate

build-up in the adjacent areas of normal stone, and there is a tendency for the surface skins of the carvings to split along the edges of the calcite veins. The arch is also pointed throughout with a 1970s cementitious mortar, which will no doubt be deflecting moisture and salts through the voussoirs leading to enhancement of the decay. Indeed, there are a number of areas where the stones have decayed against these mortars, leaving the pointing proud by several millimetres.

Towards the summit of the arch the condition of the voussoirs progressively improves, so that by the apex the final carvings are in a very good state of preservation. This is similar to the state of preservation that was observed upon the carved orders of the fourteenth-century Great West Doorway of the Minster, with the best examples of the sculpture observed towards the apex of the arch (Geoff Butler pers. comm.). Although the carvings remain relatively sheltered from the elements, many of the lower units of the arch appear to have been subject to weathering, with the softening and blurring of details noticeable. This softening may have also been enhanced as a result of cleaning cycles, which may have dissolved details previously encapsulated by surface salts. The historic failure of a number of the masonry units of the outer hood mould may have also introduced eccentric weathering patterns, with water-runs forming in areas which would have previously been protected (Figure 358). Only the uppermost carvings within the apex would have remained protected from the elements, but, conversely, would have remained more vulnerable to sulphate attack via the dry-deposition of atmospheric pollutants. A comparison between the photographs of the first survey of the figurative voussoirs by Lee Godfrey (2005) and those taken in April 2009 has revealed new instances of surface-loss during the presence of the East Front scaffold (e.g. b34, Figures 359-362). At present this appears to represent the continuation of an extant decay mechanism, which may be accelerating since the erection of the present scaffold.

As Chapter 3 of this thesis has shown, there are no clear references to intervention having taken place upon the voussoir carvings before the

twentieth century. However, the work of Shout between 1824 and 1827 provides a plausible context for the replacement of some of the carvings, with one of the most conspicuous being the renewal of b4. This carving of a crowned and bearded seated figure appears to be a replica of b46 (an original carving), which may have born some similarity to the original (Figures 363 and 364). Some of the canopies also appear to have been renewed at some stage, and differ from their medieval counterparts in that they have not been fully pierced and bear evidence of bolster tooling (Figures 365 and 366).

Signs of previous intervention other than replacement are evident in the form of surface treatments and the casual plugging of small cavities with a coarse-lime mortar. The brown-yellow staining to the surfaces of the carvings is indicative of previous treatment with linseed oil (Figure 367), recorded in the Detailed Time Accounts as having taken place c.1916 (YM/Acc.1967/11, 1974/7). The appearance of these stones also compares favourably with the decorative cornice of the clerestory of the eastern arm, which is also known to have been coated with linseed oil after its renewal in the wake of the 1829 fire (YM/B3/7). As has already been discussed in Chapter 3, linseed oil was used by the masons for many years and the references in the Detailed Time Accounts may document only one instance of a practice often repeated each time the stonework was visited. It is possible that other campaigns of cleaning and minor repair could have taken place during the installation of the first protective glazing scheme in 1861. In some cases, it appears that the decay process has been contained by the application of the oil, where hollows that were once decaying now appear stable, but stained brown. Where plugging with coarse mortar has been employed it also seems to have inhibited the progression of the decay. Finally, there are examples where a medium other than linseed oil (perhaps pigmented limewash) have been applied. In particular b45 appears to have been consolidated in this way, having once been in poor condition judging by the loss of detail (Figure 368). The Virgin and Christ also show signs of a yellow-tinted coating, and suggestions of coatings can also be seen on b4.

The final significant phase of intervention to recall is connected with the work of Sir Bernard Feilden, which has already been outlined above. This involved the sustained water-washing of the sculptural surround, which, as the 1940s and 1950s photographs indicate, was heavily sulphated by this time. It is possible that this prolonged programme of cleaning mobilised substantial quantities of sulphates, which is likely to have significantly enhanced the decay of many of the voussoir carvings. The water washing of the stone above and adjacent to the carvings, as well as the voussoirs themselves, would have transported and redistributed the surface sulphates around the arch, whilst at the same time perhaps breaking down the integrity of the linseed-oil coating. Sulphate-laden water would have run down the arch from above, concentrating in the lower carvings where it would have remained until evaporation, after which recrystallisation of the salts, and therefore deterioration, would have ensued. This is a very similar scenario to that which relates to the Great West Doorway of the Minster, where its deterioration was seen to manifest at an alarming rate post-cleaning (YML/E7/1/2). Indeed, the photographs of the voussoirs taken after cleaning in September 1971 show the figures much sharper than they are today. This is strongly emphasised when comparing the condition of seated king b4 in 1971, when it was photographed at close-range, and its condition in 2009 (Figure 369). Overall, therefore, it would seem that the period of surface deterioration of these voussoir carvings has been largely confined to the last forty years, since they were water cleaned.

The seated figure

Within the niche directly above the east window arch is the large seated figure made up of three separate stones, one on top of the other (Figures 370-379). At present, the statue exhibits no evidence of progressive cavitation. However, some spalling of the cementitious pointing applied during the 1898-1900 repair has taken place. This phase of work also saw the head section of the statue grouted with neat OPC to secure open bedding planes. There appears to have been little, if any, adjacent attrition of the stone since the superficial application

of these cements. However, on comparing the form of the statue as photographed in the 1950s with its current state, it is evident that a gradual erosion of detail has been taking place to leave the figure harmoniously weathered (Figure 380). There is also considerable biological growth affecting areas where moisture has been held within the stone. This retention of moisture has been caused by the presence of the hard cement mortars.

Although much detail has been lost over time, the overall form of the figure is still discernible, especially from the ground. The base stone is naturally bedded and the legs, left foot and folds of drapery are still discernable, along with the sides of the seat on which the figure rests. The central torso and head sections are face-bedded. The left hand holds the weathered form of a gabled building, while the right hand is very weathered and lacks a discernable gesture. A neck garment features upon the torso section and hangs across the chest. The head section is also weathered, although the form of a headdress and the general outline of the face can be read. Flowing locks of hair are also discernable either side and to the rear of the head, which also includes the remnants of holes for metal fixings.

Recent removal of c.1900 cement mortars and ashlar work from around the base of the statue has also shed valuable new light on the archaeology of the statue. This has revealed the presence of a bronze armature linking the base of the figure to the parapet masonry (Figure 381). This suggests that the base of the statue does not penetrate the full depth of the eastern face of the façade. Indeed, it would seem that the figure once stood proud of a much deeper niche and secured with metal fixings, before the renewal of the parapet to a bulkier design in the early twentieth century.

Examination of the surface finishes concealed within the mortar joints of the statue during the cement removal has also exposed evidence of claw tooling on each of the stones (Figures 382-385). This makes it highly likely that they pre-date the main repair campaigns of the eighteenth and nineteenth centuries. However, while the base section appears to be *in situ* primary material, the torso and head stones are face-bedded and do not read coherently with the base

section, appearing too broad in proportion to the legs. Moreover, the removal of ashlar work from behind the base of the figure indicates that the base stone was originally concave to the rear (perhaps to minimise weight), while the upper two stones were left flush (Figures 386 and 387). On fixing these stones, the evidence suggests that the hollow behind the base was filled with rubble to add support to the full-depth sections above. Exposure of the right shoulder of the figure also indicates that the rear of the head section had required repair at some stage. Owing to the face-bedding of the stone, it appears that material had detached along a calcite fault before it was re-fixed (and then later re-pointed) using lime-based mortars (Figures 388-390). Therefore, it is possible that the upper two stones represent early renewals that, appearing geologically very close and sharing similar building technologies, are contemporary with one another.

The unusually large widths of the mortar joints also suggests that the statue has been dismantled and re-erected in the past, perhaps during the rounds of post-medieval repairs to the parapet, or during the 1820s restorations by Shout. That dismantling was not undertaken during the c.1900 parapet renewal is suggested not only by the rough, punching-out of the New Ketton stonework to make it fit around the statue (which remains out-of-plumb against the later masonry), but also because the stones are fixed on lime mortar rather than cement.

The interior carvings – summary of arrangement and condition

The fourteen angels and the eight crowned busts

The interior voussoirs of the Great East Window arch all appear to be fourteenth-century originals and are in an excellent state of preservation (Figures 391-398). They incorporate a sequence of fourteen angels under canopies on the upper order (seven each side), and eight crowned busts under canopies on the lower order (four each side). Interestingly, there are further vacant niches within the orders, immediately below the figurative carvings. The upper order has two on each side, while the inner order has one on each side.

However, whether or not these niches ever accommodated further carvings is unclear owing to the layers of limewash.

As the voussoirs progress towards the apex of the arch a number are truncated, perhaps due to the accumulated loss of space brought about by the mortar joint-width, which may not have been compensated for when the arch was originally set out (Figure 392). Alternatively, the builders may have decided to compress the height of the arch during construction, thus reducing the height of the stones towards the apex subsequent to their original manufacture. Whilst the overall finish of these carvings remains relatively clear, much of the tooling and detailing has become obscured by several consecutive coating applications.

The fourteen angels beneath canopies that occupy the upper order of the arch are in excellent condition, with all carvings appearing to date from the second half of the fourteenth century. All of the angels are half-figures resting on clouds, and all have raised, enlarged hands, with the exception of one (c15, Figure 395). This angel has its hands lowered, resting upon its cloud. A number of the angels and canopies have been superficially damaged at some point, perhaps during previous scaffolding operations. This damage is invariably confined to the most delicate elements of the carvings, such as the fingertips on the figures and the crockets on the canopies.

The eight crowned busts beneath canopies occupy the lower order, or soffit, of the arch at regular dispersed intervals up to the apex. The busts wear crowns and have beards, with the exception of d9, which is crowned but has no beard (Figures 396 and 397). Again, these carvings are in an excellent state of preservation, although the crispness of their finish is impaired by the previous coating applications. A significant feature of their design and fixing is their progressive adjustment to lines of perspective. The carvings turn within the arch towards the viewer on the ground, with the undersides of the canopies over-represented to give the impression that the viewer is looking directly up into the niche (Figure 398). This effect may have been a fortuitous by-product of the size and nature of the stones that were available to the carvers, since it is possible that the busts were worked *in situ.* Originally, they may have initially

functioned as blank support stones for the timber centring of the east window arch, after which they were carved to contribute to the iconography.

Chapter 3 has shown that the intervention history of the interior sculpture appears comparatively modest. As already noted, all of the carvings of both orders of the arch appear to be fourteenth-century originals, although the extant surface coatings may yet conceal evidence of previous renewals or alteration. The only likely context for any replacements would be the repairs following the 1829 fire, although just cleaning and, perhaps, limewashing seems more likely. Due to the presence of the surface coatings it is difficult to assess the presence and/or extent of any fire damage, and Robert Smirke's statement that the Great East Window had 'suffered very little injury' (YM/B3/3/1, 5) may be enough to suggest that the sculpture made it through the fire unharmed.

A number of surface coatings can be observed upon the interior figurative work around the east window, as well as upon the window masonry itself and the surrounding niches down to sill level. Three coatings feature upon the surface of the voussoir and soffit carvings (Figure 399); a) a plain white-grey limewash, which overlies b) a yellow-brown coating (presumably lime-based), which overlies c) a plain white limewash (which may be a priming coat for b)). These coatings are only superficially understood at present, and it is possible that the existing layers of limewash around the arch of the East Window conceal traces of original polychromy. The coatings are flaking off in many areas, although with no apparent detriment to the surface of the stone beneath. There do not appear to be any instances where the coatings have been detrimental to the condition of the carvings.

The archival evidence relating to the cleaning and application of coloured and plain washes to the interior elevation of the East Front, and Minster in general, has already been noted. It is possible that the extant coating (b) relates to the refurbishment of 1793, being yellow-brown in tone. It is likely that this treatment would have been much brighter when first applied, before dulling-down over time through the combined effects of dust, soot and candle vapour. Some years later John Browne (1847, 318) was to lament this act of

refurbishment, claiming that the 'remnants of former embellishment' had indeed been lost during the process. If this comment is to be taken literally, then the 1793 work could indeed be concealing earlier polychromy. Alternatively, coating (b) could relate to the restoration of the eastern arm after the 1829 fire (especially as the walls had apparently been soot-blackened) or to the brief programme of cleaning and repair to the Great East Window and vaults of the eastern arm in 1844 (YM/B3/5/10).

The final act of refurbishment around the window took place in 1970 and 1971 after the underpinning of the East Front and the reinforcement of the east window tracery with stainless steel cables. These cables pass into the arch at intervals, and, regrettably, had to enter via the carved angels. To coincide with the exterior washing noted above, the interior was also cleaned where necessary and given a coat of limewash, which survives as coating (c).

Interpretation and possible iconography

The dating of the sculpture

Broadly speaking, all of the sculpture identified as being original must date to the second half of the fourteenth century. Supported by contemporary examples of sculpture, stained glass and manuscript illuminations, the documented dates of 1361-c.1373 for Thoresby's campaign provide a convenient 'window' in which the seventeen sill carvings and interior arch sculpture can be placed. However, the structural evidence already outlined above suggests that the exterior voussoirs were inserted some years later. A number of stylistic parallels also bear this out, placing the manufacture of the exterior carvings, and therefore the mullions and tracery, within the 1390s. In turn, this may help to explain the content of the inventory of 1399, with the insertion of the window units actually triggering the stockpiling of glass for the eastern arm.

The busts beneath the exterior sill of the east window and within the interior soffit of the arch bear some similarity to a boss recovered from the site of Blackfriars, Gloucester, which has been dated to c.1350-1375 (Park 2002, 82;

Figure 400). The depiction of the forked beard became frequent by the end of the fourteenth century, and can be found in illuminated manuscripts such as the Psalter of Stephen of Derby 1348-74 (Sandler 1986, 142 cat. 128 cited Park 2002, 82; Figure 401). The busts at York also bear some similarity to the demi-figures that feature within the glazing of New College Oxford, which was overseen by Bishop William of Wyckham during the 1380s (Figure 402). Furthermore, the tendency to carve the hair in twists is found in both the sill carvings and the busts forming the bases of the first tier of niches of the East Front. All are structurally integral; the bases run through into the niches and the outermost sill busts are bonded with the buttresses on both sides.

The fourteen angels bear striking similarity to those which flank the royal tomb effigy of Edward III in Westminster Abbey (Figure 403), where the pose and clothing of the angels is closely shared by both. This tomb was commissioned by Edward's son, Richard II, in the 1380s (Duffy 2003, 148). This practice of flanking royal images with angels may have been established by the east window at York in the late 1360s, which was to then inspire the art of the royal tombs at Westminster. That the York angels may be slightly earlier in date is conceivable, as Edward III had already shown an affinity towards the representation of angels on tombs, having already commissioned a series to flank the effigy of his wife, Phillipa of Hanault (†1369), by 1376. This motif may then have been adopted by Richard II for his father's tomb in the 1380s.

The variety of carvings within the exterior voussoirs also provide valuable opportunities for comparative stylistic analysis. General similarities can be drawn between the York kings and the late fourteenth-century statues of the Gallery of Kings inserted into the West Front of Lincoln Cathedral, and the kings of the west façade of Exeter Cathedral (Figures 404 and 405). The cross-legged motif used on figure b34, which is thought to represent power and authority, also features amongst the Lincoln and Exeter kings (Broughton 1996, 37). This symbol may also be found on a fourteenth-century roof boss at Exeter that may represent King David (Cave 1953, 40; Figure 406). Even closer similarities can be marked with a series of late-fourteenth century manuscript illuminations

depicting royal figures (Figures 407 and 408). Chief amongst these are the four principal illuminations of the *Liber Regalis*, which Paul Binski (1997, 244-245) has dated to the late 1390s. The detailing and posing of the figures in the *Liber Regalis* is extremely similar to those of the York kings, especially the form of the throne and clothing, and the use of the forked beard (Figures 409-412).

The Coronation of the Virgin arrangement at the apex of the exterior voussoirs is a common scene throughout fourteenth-century religious art. By returning to the Court Art of Westminster, however, a close relationship between the east window carvings, the representation of the King and Queen in the *Liber Regalis* and the tester of Richard II can be argued (Figures 413-414). The tomb was commissioned by Richard himself and erected and finished within his lifetime between 1395 and 1398 (Duffy 2003, 164-165). The tester bears the Royal Arms, along with angels and a depiction of the Coronation of the Virgin surmounted by Christ in Majesty.

The iconography[13]

Iconographical studies of the eastern arm have been dominated by the study of its stained glass, with special emphasis placed upon the Great East Window and the windows of St. William and St Cuthbert in the choir transepts. Research by Norton (2005) has been able to place the Great East Window in its wider architectural context, demonstrating that Thornton's glazing scheme functioned as a giant reredos to the rood above the high altar. In light of the current proposed conservation of the Great East Window, the desire for further work on the meaning of the window has been generated. While scholarship continues to say more about the intricacies and message of the glazing, there is broad agreement on its main subject matter (Figure 336). For the purposes of this thesis this provides a basis from which the iconography of the East Front can be

[13] I am indebted to Lee Godfrey for the many discussions and insights he has provided into the iconography of the East Front. The contributions of Professor Norton and Sarah Brown are also recognised here.

explored. However, it is beyond the scope of this report to reconsider the finite arrangement and details of the east window glass. Rather, the purpose of the present study is to draw attention to the combined significance of the stone and glazing so that further research may be facilitated.

In comparison to the level of scholarship committed to the understanding of the glass, the sculptural ensemble of the East Front has come a poor second. No detailed interpretations of the significance and iconography of the exterior or interior carvings have been published, since opportunities to access and inspect the voussoirs close-up have been understandably limited. Chapter 3 of this thesis shows that since the time of the antiquarian Thomas Gent (1730, 58) the seated figure was thought to represent Archbishop Thoresby in commemoration of his generous patronage. Until recently this view remained largely unchanged, save for the suggestion by Feilden that it was intended to stand for Christ in Majesty (YM/E7/1/1/v2, 1070-1090). Sarah Brown's (2003, 156) idea that the figure might represent St. Peter is feasible and has gradually become the accepted view (Godfrey 2005, 34-36), but there has been no published synthesis as to why this should be the case. The understanding of the meaning of the other groups of sculpture on the exterior and interior also remains vague, with the accumulated view being Christ and the Apostles flanked by two princes, with King Edward III and Thoresby completing the frieze at the south and north ends respectively (Gent 1730, 58; Drake 1736, 484-487; Browne 1847, 277).

The most useful published descriptions of the arch carvings are only very recent and are provided by Sarah Brown (2003, 154-156). The exterior voussoirs are outlined as seated kings under canopies, some holding scrolls, with alternating sprays of foliage and lions' masks completed by the Coronation of the Virgin scene at the apex. Inside, the angels are recorded as a continuous band of adoring angels under canopies, and the crowned busts given as kings under canopies.

The subject matter according to Brown (2003, 154-156) therefore runs as follows:

Exterior:

Seated figure – represents St Peter

Voussoirs – Seated Kings under canopies, some holding scrolls, alternating with sprays of foliage and lions' masks. Coronation of the Virgin at apex

Row of carved heads beneath sill – a frieze of seventeen carved male heads

Interior:

Angels – a continuous band of adoring angels under canopies.

Crowned busts – the busts of kings under canopies

Clearly, the current scaffold access to the east end provides the first opportunity to examine these sculptural elements at close quarters for some forty or so years, and much has already been achieved since this scaffold has been in place, most notably by Lee Godfrey whose MA in Conservation Studies dissertation explored the iconography and significance of the East Front exterior carvings (Godfrey 2005). This study provides a valuable platform for further analysis. However, the survey that follows is in itself superficial, and further iconographical and art-historical research may be necessary to attempt to establish the identities and meanings of the individual figures within each order of sculpture. Likewise, the possible relationship between the carvings and the patronage of the Crown might merit further investigation in the future.

The seventeen carved heads need further study, but may well represent Christ and the Apostles, flanked by Edward III and Archbishop Thoresby as first proposed by Gent (1730, 58), and refined by Drake (1736, 486) and Browne (1847, 277). However, the suggestion by these scholars that the penultimate figures at each end were depictions of anonymous princes is problematic, and judging by the character of the heads as shown in Figures 54-62 it is far more likely that these were additional biblical figures. If seventeen had been the

intended number (as opposed to an appeasement of architectural constraints), then this may have been used to represent the seventeen prophetic books of the Old Testament (Godfrey 2005, 16), with the theme of prophecy having been recently identified by Professor Nigel Morgan (2008 pers. comm.) as a keynote of the east window glazing. This group may have also been intended to convey Thoresby's celebrated view of the church and state aligned, with the busts of Edward III and the archbishop linked by Christ and the Apostles. At this level, the figures of Percy and Vavasour within the outer niches should not be forgotten either. The inclusion of donor figures in the lowest tier of niches would have chimed well with the lowest tier of glazing panels, which includes the donor scene. Tentatively, this may indicate that it had been intended for the remaining East Front niches to carry further images to complement the window, being a scheme that was then subsequently lost, or perhaps never completed.

Moving inside, it is conceivable that the fourteen angels flanking the eight crowned busts may have been installed in anticipation of the subject matter of the tracery, i.e. to convey a collective representation of heaven in stone and glass. The angels, residing in heaven and flanking God the Father in the head of the tracery, raise their hands in prayer for the crowned figures who ascend into heaven (Davidson 1994, 9; Mâle 1961, 382-383). The number fourteen is important as a representation of the Resurrection (2x7), and that there are also fourteen angels in the tracery glass is perhaps significant. The number eight may also prove to be important, since eight is also thought to represent rebirth (7+1) and the number of souls that were saved from the Great Flood (1 Peter 3:20[14]). However, if the vacant niches within these orders were ever filled then this would inevitably develop the number symbolism and, potentially, the iconography. This is certainly worth considering in the case of the angels, as the figurative completion of the niches would have brought the number to nine each side to give the Nine Orders of Angels.

[14] Bible references taken from the New International Version

The likely explanation of the primary meaning of the exterior voussoirs is that they depict the Coronation of the Virgin surmounting Christ's Royal Ancestors, the Kings of Judah, as taken from the Genealogy of Christ in Matthew 1:1-17 (Godfrey 2005, 23). Despite being used as a border motif throughout the eastern arm, the lion masks appear to have been deliberately used here to reinforce the identity of the figures as the Kings of Judah, whose symbol was the lion (Revelation 5: 5; Mâle 1961, 168). Similarly, the foliage motifs are employed more purposefully in this case to serve as the branches of the family tree, or vine, as well as Christ himself (John 15: 1). A broadly contemporaneous example from France of this type of foliage has indeed been identified as the vine (Figure 415). The coronation of the Virgin as Queen of Heaven was an obvious choice of subject given the function of the end bay of the eastern arm as a Lady Chapel (Brown 2003, 156). Yet the presence of the crowned Virgin may itself be significant in the context of the theme of heaven in the glazing. It is possible that in this guise she would have offered a further glimpse into heaven to directly reinforce the meaning of the tracery below (Davidson 1994, 8). Of further interest is that the Coronation of the Virgin scene was also employed at the apex of the large east window at Melrose (Fawcett and Oram 2004, 104; Figure 417).

Matthew's genealogy runs from Abraham to Christ and is divided into three main groups of fourteen generations, with each group marked by a significant historical event. The three divisions are:

1. Abraham to the reign of King David (Matthew 1: 2-6)
2. David's Kingdom to Babylonian Captivity (Matthew 1: 6-11)
3. Release from Babylonian Captivity to Christ (Matthew 1: 12-16)

Giving:

Abraham to David	*David to Captivity*	*Release to Christ*
Isaac	**Solomon**	Shealtiel
Jacob	**Rehoboam**	Zerubbabel
Judah	**Abijah**	Abiud
Perez	**Asa**	Eliakim
Hezron	**Jehoshaphat**	Azor
Ram	**Jehoram**	Zadok
Amminadab	**Uzziah**	Achim
Nashon	**Jotham**	Eliud
Salmon	**Ahaz**	Eleazar
Boaz	**Hezekiah**	Matthan
Obed	**Manasseh**	Jacob
Jesse	**Amon**	Joseph
[David]	**Josiah**	Jesus Christ

* NB names in **bold** indicate Kings of Judah

It is important to note that Matthew's account is an abridged version of earlier lists and that he omits some names. So, while Matthew's genealogy often forms the key source for depictions of the ancestors of Christ in art, these iconographies are frequently expanded, or contracted, depending on the desire of the patron and the constraint or freedom associated with the media and architectural form in which it was to be conveyed.

The complete list of the Kings of Judah is as follows (names in **bold** are omitted by Matthew; see also Figure 418):

Saul	**Amaziah**
David	Uzziah
Solomon	Jotham
Rehoboam	Ahaz
Abijah	Hezekiah
Asa	Manasseh
Jehosaphat	Amon
Jehoram	Josiah
Ahazia	**Jehoahaz**
Athalia (Queen)	**Jehoiakim**
Jehoash	Jehoiachin (Jeconiah)
	Zedekiah

The genealogy was commonly conveyed in Gothic painting and sculpture as the *Tree of Jesse* after Isiah's prophecy (Isiah 11: 1-3). Indeed, the Minster itself appears to have had a particular affinity for Jesse windows. These may be found in the south aisles of the nave (s33, c.1310-20) and eastern arm (s8, c.1386), while a figure from a lost twelfth-century scheme also survives (Brown 2003, 8, 284, 289; Figures 419-420). Beyond York, the most famous fourteenth-century example of the *Tree of Jesse* is the Jesse Window at Dorchester Abbey, which incorporates both stone *and* glass to deliver its message (Figure 421). However, the apparent absence of Jesse in the York voussoirs, (perhaps because Jesse was not a king) implies that the York iconography is not explicitly a Jesse Tree as suggested by Godfrey (2005, 27). Rather, it intends to place collective emphasis on the royal kinship of Christ. This would not be unusual by this date, as there are other instances of the abstraction of this scheme. At Lincoln, for example, the Gallery of Kings may be an edited version of the tree to emphasise (albeit ambiguously) Christ's Royal Ancestors (Broughton 1996, 37-38). Indeed, it is

believed that such Genealogies had earned a dual meaning by the fourteenth century, whereby the Kings of Judah also represented the earthly heads of state (Murray and Murray 1998, 192). This inherent ambiguity was certainly a factor in the restoration of the statuary on the West Front of Lichfield Cathedral between 1877 and 1884 (Cobb 1980, 149). Traditionally, the first row of statues above the doorways were believed to represent the Kings of Judah, and it was not until their renewal by Sir George Gilbert Scott that the decision was taken to portray them more explicitly as the Kings of England (Cobb 1980, 140, 148-149; Scaife 2010, 13; Figures 422-423).

At York, then, it appears that special emphasis was being placed on Christ's Royal Ancestors and that the seated figures represent a selective depiction of the Kings of Judah from David to Jehoiachin. Whether or not the figures were assigned any specific attributes to make them individually identifiable is at present unconfirmed. An exception is b4 on the lower right, now a nineteeth-century restoration. This may have originally been a representation of King David with the harp, only to be expediently restored in the nineteenth century with the copy of b46. It is also possible that the scrolls held by the figures originally bore painted names to convey the identity of each character. The Green Man motif, being a product of the 1915 restoration, may have once been an image more complementary to the coronation scene below. A representation of God the Father or the Holy Spirit are considerations, being items which frequently appear in medieval representations of the Coronation of the Virgin to form the Trinity (Davidson 1994, 8). That the boss was intended to represent 'The Bright Morning Star' (Revelation 22: 16) is also a further possibility (Godfrey 2005, 115).

It is highly unlikely that the seated figure was originally intended to represent Archbishop Thoresby for two reasons. Firstly, it is probable that Thoresby already features as one of the sill busts beneath the window. Secondly, it is unlikely that the Archbishop would have arrogantly placed himself above Christ, the Virgin and God (in the glass) on the façade (Godfrey 2005, 35). Assuming that the patron was always commemorated in spectacular fashion

was a common misconception of antiquarians (e.g. Poole and Hugall 1850, 66-67). This could lead to ill-informed interpretations and restorations of sculpture. An important example of this at York is the nineteenth-century restoration of Archbishop Melton above the Great West Doorway. The earlier weathered statue was replaced with an image of Melton as patron of the nave, yet the surrounding iconography (attending angels above the Genesis cycle) suggests that the Virgin and Child, St Peter, St. William or Christ are the more plausible subjects of the original statue (Brown 2003, 120-121). If the upper two-thirds of the seated figure above the east window are indeed replacements (albeit early), this also raises questions over the original identity of the statue. If the extant design was at least informed by the form of the original statue, i.e. a mitred, seated figure, the original subject may have been St. Peter as gate-keeper of heaven (conveyed in the tracery below) and patron of the cathedral. If this was the case, then the figure may have once been comparable with the near contemporary examples, including several within the Minster, shown in Figures 424-427, complete with papal tiara.

A further option, however, is that the figure was originally a depiction of Christ in Majesty, perhaps paralleled by the arrangement on Richard II's tomb-tester at Westminster Abbey and similar in form to the fourteenth-century survival that sits over the central western doorway at Lichfield Cathedral (Figure 428). This would obviously complement, and provide a climax to, the emphatic use of kingly imagery throughout the east front sculpture. Perhaps more significantly, an image of Christ in Majesty would serve to reinforce the vision of the Old Testament Prophets and the Book of Revelation (depicted in the Great East Window). As such, the identity of the seated figure remains very open to interpretation, and its present form could be seen as the result of an early phase of alteration. This may have even been an act of iconoclasm, which would have swept away the evidence on which any later interpretations might otherwise have been based. This is particularly true for the statue as St. Peter as it appears that a concerted effort was made after the Reformation to erase images that bore any association with Rome. Intriguingly, several of the carved shields

bearing the arms of St. Peter have had their surmounting papal tiaras carefully chiselled away (Weir 1986, 16; Figures 429-430).

To conclude, the exterior and interior sculptural reliefs of the East Front are clearly of national and international significance. Firstly, in its national context, Gothic portal sculpture is rare in England, and it is even more unusual to encounter such sculpture in window surrounds. This only begins to be rivalled by the east window of the Beauchamp Chapel at St. Mary's, Warwick, which bears sculpted wooden angels and female saints beneath canopies. However, the Beauchamp Chapel is considerably later in date, having been constructed between 1439 and 1462 (Monckton 2004, 26). Although short of the sculptural achievements on the West Fronts of the cathedrals of Wells and Salisbury, for example, the iconographical programme of the East Front of York Minster nevertheless stands as one of the most monumental in England. On a European scale, the representation of Old Testament figures (as featuring in the *Genealogy of Christ* within the arch of the Great East Window) is considered rare after the late twelfth-century and the fact that a relationship between the subject matter of the glazing and the carvings exists is also very unusual, adding further weight to the importance of the figures at York. The carvings as a group rank highly as examples of late-medieval craftsmanship in general, and certainly equal the renowned examples at Lincoln and Exeter, for instance.

On a more local scale, Chapters 3 and 4 have explicitly shown how the East Front has seen the extensive renewal of its fabric over time, with comparatively little original medieval decorative work surviving on the exterior. Substantial amounts of the primary stonework of the interior were also lost as a result of the 1829 fire in the choir. This, coupled with the received acceptance that much of the remainder of the Minster has also been renewed in the past, reinforces the importance of the sculptural ensemble of the East Front. Since the majority of the carvings are original, they are one of the few intact reminders of the collective vision of the medieval craftsman and patron to have survived at York Minster. As such, their appropriate conservation is therefore of the utmost importance.

4.4 CONCLUSION

This detailed analysis of the construction and repair sequence of the East Front has served to reveal the rich complexity of the archaeology of Thoresby's east end. It has shed detailed light on the extent, nature and meaning of the medieval fabric, as well as the history of its repair and maintenance. Collectively, this study makes a substantial contribution to the evolving understanding of the Minster's architecture. While some previous hypotheses have been re-affirmed, others have been challenged and revised.

Beginning with the medieval building campaign, this survey of the archaeology of the East Front has revealed all the hallmarks of a structure erected in great haste. The poor foundations and irregularities in plan set a course for design and structural problems for which solutions are still being sought today. Normally, the rate of construction was dictated by the supply of stone from the quarry coupled with the provision of templates from the master mason. However, in the case of the remodelling the east end, an immediate and substantial supply of stone from the redundant twelfth-century choir coupled with comparatively little ornamental and moulded work in the lower stages of the façade meant that building could commence fairly rapidly. Setting the archaeology against the documentary evidence, the structural completion of Thoresby's east end, and therefore the East Front, could certainly have been achieved between 1361 and 1373 when the archbishop died. By medieval standards this was comparatively fast, and is likely to have led directly to the problems of structural instability that have challenged the masons ever since.

The initial phases of building focused on the East Front itself, with the façade carried up in advance of the aisle walls and arcades in order to receive their thrust. The completion of the lower storey to the level of the east-window capitals may have been achieved by 1368, if not earlier (French 1972, 311, 315). The upper levels of the east wall and clerestory then followed. This was to a revised design that was perhaps led less by aesthetics and more as a solution to the behaviour of the lower levels of the structure during building. Whether or

not this innovative evolution in the design of the upper storey can be attributed to the appointment of Patryngton as master mason remains open to question, and the York masons may have indeed taken collective responsibility for the improvements that were made (Brown 2003, 162). The skeletal nature of the construction at this level enabled a reduction in the amount of solid masonry bearing down on the work below. The buttresses were also were heavily modelled and progressively reduced in plan to mitigate the change of overloading the leaning sections below. Despite these measures, however, it appears that the structural problems were not solved straight away. Cracking through the easternmost bay of the north clerestory, as well as perhaps through the adjacent ashlars connecting the clerestory to the façade on both sides, led to the repair and modification of the design of the screenwork. Likewise, a series of ad-hoc solutions appear to have been implemented upon the final levels of the central buttresses. This resulted in the unification of the existing turret and spirelet sections with the altered buttress faces by means of decorative coronas. Whether or not these works took place within the main 1361-1373 campaign is hard to determine. However, the similarity in approach to the buttress coronas with those that complete the overtly Perpendicular aisle turrets suggests that this may not have been until into the fifteenth century.

The precise timing and context in which the Great East Window masonry was installed may never be fully understood. However, close study of the archaeology of the window has been able to further refine certain aspects of the window's conception, while also offering new interpretations of the date, style and meaning of the sculptural programme and its relationship with the glazing scheme. This has shown that while the sill carvings and interior voussoirs fell within the main building campaign of 1361-c.1373, the exterior casement and voussoir carvings were installed some years later with the mullions and tracery. Stylistic similarities with the Court Art of Richard II suggests that this may have been the late 1380s or 1390s. In all, the carvings represent an exceptional ensemble of late fourteenth-century sculpture in both national and international contexts, as well as in the context of York Minster since so much of the exterior fabric has been renewed in the past.

Leading on to the archaeology of repair, with intervention on the façade seemingly underway within the medieval period (and perhaps even during construction), the masons of the centuries that followed have clearly made a considerable contribution to the archaeology of the façade also. Few elements have escaped renewal, which now places a heavy burden of significance on those that have survived more intact, such as the exterior voussoirs. Perhaps the most important overriding consequence of this study is proof that the archival sources and physical fabric of the building cannot be used independently of one another to effectively and thoroughly understand the building. While the archives provide valuable dates and contexts for previous work, it is invariably the building itself which defines the eventual remit of intervention, and the reasons for it. Conversely, the documentary sources are crucial to understanding the background and frequency of repair, especially at high level, while the fabric can only shed light on the most recent phase of intervention in most cases. Taken together, this study has shown that the façade is now largely composed of nineteenth and twentieth-century masonry. Over time, the recessed and sheltered elements have been the most vulnerable to decay, seeing most of the ornamental work sustained by renewal and each generation tackling the same problems as the one that preceded it.

The impact of the nineteenth and twentieth-century masons, and especially William Shout, has been enhanced by the archaeological survey. Interestingly, the documentary and archaeological evidence suggests that the 1829 fire did comparatively little damage to the East Front itself, with the worst of the effects confined to the western choir, and the piers and clerestory of the eastern arm. Furthermore, it seems that while the drawings, contemporary acknowledgments and extant nineteenth-century masonry shows that close attention was paid to the accuracy of the overall design during renewal, the faithful interpretation and re-instatement of the enrichments was less of a priority, with details such as crockets or foliage increasingly simplified or repetitive. The selection (or availability) of adequate stone during this period bears out the criticisms of later commentators, with rates of failure having overtaken those of earlier fabric. This overwhelming attrition of the magnesian

limestone led to the introduction of alternatives such as New Ketton, which have performed equally poorly in many situations. The depth of enrichment of the building also continued to be affected as a result, with the workability of the Ketton and Clipsham stones rendering carved work shallow and frequently oversized. Only since the renewed use of magnesian limestone, coupled with a perceived reduction in air pollution, has this damaging scenario begun to reverse.

The final important aspects to draw from this survey are more positive. In particular, the use of plastic repairs by generations of masons as a valid practical solution has been recognised, along with the practices of cleaning and surface treatment. The archival sources provide a valuable basis of comparison with the fabric of the building to enable a clearer understanding of the rates of decay and the frequency of repair. Ultimately, it has been seen how problems are rarely new, and in particular those that relate to the structural behaviour of the eastern arm. These issues are considered in Chapter 5, which returns to the questions raised at the beginning of this thesis and explores the contribution and relevance of this research to the practical conservation of the East Front and the emerging questions that would benefit from further study.

CHAPTER 5

CONCLUSION ~
Towards conservation

Chapter 5 returns to the questions and issues raised in Chapter 1 and explores how the analyses presented in Chapters 3 and 4 have impacted upon the ongoing conservation of the East Front. Importantly, it will show that through an intimate understanding of the building and its repair history it is possible not only directly to inform the practical approaches to conservation, but also to develop a building-specific philosophy of research and repair.

In terms of practical conservation, this chapter will show that by extending the remit of buildings archaeology beyond historical enquiry it is possible to both inform and facilitate repair. This is achieved through the detailed documentation of the condition of significant stones and current interventions, as well the design and monitoring of *in situ* repair trials. Significantly, it will also demonstrate that through the development of a close working dialogue with the craftsmen of the Stoneyard it is also possible for research and analysis to support the prospection of stone for renewal and to enhance the approach to design. In concluding this thesis, Chapter 5 will end with a review of the broader impact that this study has made on conservation policy at York Minster, which raises new challenges and opportunities for the integration of research and analysis into the future care of the cathedral, and cathedrals in general.

5.1 Buildings archaeology and the East Front of York Minster – the impact and value of research and analysis

Chapter 1 of this study presented the key research aim of this thesis. This was to enhance and transform the understanding of the history and significance of the East Front through the lens of buildings archaeology in order to more effectively inform its conservation. As considered in Chapter 1, the iterative

nature of the research coupled with the evolving dialogue with the Stoneyard also raised further questions regarding the history and culture of craft practice at the Minster, and the opportunity to reconsider the contribution of buildings archaeology to the practical processes of repair. Having presented a detailed analysis of the East Front in Chapters 3 and 4, it is now possible to explore the extent to which the aims of this research have been met by considering each stage of practical conservation and the role that this research has played in their development.

Taken together, it can be argued that Chapters 3 and 4 constitute a detailed, long-term biography of a part of York Minster. The close attention paid to both its construction and repair has shaped a new understanding of its architectural history and the performance of the materials used, as well as the practices and attitudes of those who built and maintained it. The result is a rich archaeological palimpsest. While the understanding of the primary fabric has been much enhanced, it has also been possible to raise the relevance and significance of the post-medieval archaeology of the East Front, and Minster in general, to an unprecedented new level. These findings have shed valuable new light not only on the changing condition of the façade and its long history of structural problems, but also the human contribution to its decay or preservation, and the alterations to its design over time. Significantly, the observations made throughout this research have also informed the selection of certain materials and methods for repair, which the author has also designed or directly undertaken in a number of instances.

Set against English Heritage's (2008, 28-32) key values that contribute to a building's significance, the findings of Chapters 3 and 4 greatly transform the ways in which the importance of the East Front should be perceived. The physical fabric has clear evidential, aesthetic and spiritual values. This is exemplified by the spectacular sculptural ensemble, which combines some of the finest carvings to have survived on the Minster with the complex design and iconography of the Great East Window. Moreover, profound evidential and historical value can also be placed upon the façade beyond its medieval

incarnation as an index of past restoration and conservation methods. Importantly, this index can be drawn upon to inform practice in the present so that, in essence, the building and its history becomes the model for its conservation. These important aspects of the facade reinstate connections between phases of repair and actual craftsmen, such as William Shout and Sam Monk, and prominent architects, including John Carr, the Smirke brothers, GF Bodley and Sir Bernard Feilden.

On the one hand, it might be suggested that the revelation of such significance should call for the *in situ* preservation of stonework by default. However, what will be argued throughout the remainder of this chapter is that when this level of understanding is used more proactively, it can better inform, support and even facilitate change, as well as providing a means to accept it. The purpose of the following section of Chapter 5 is to explore this potential further by examining the ways in which an enhanced understanding of the fabric of York Minster from an archaeological perspective can, in fact, contribute to philosophy and practice at every level.

5.1.1 Condition, rates of decay and documentation

The outcomes of this research have greatly enhanced the list of 'memory-effects' which have contributed to the condition of the stonework of the East Front. Furthermore, the range of archival sources have provided a valuable basis of comparison in understanding the pace of decay, while the archaeological analysis has been able to closely date the units of the building enabling assessments of their alteration since their insertion. This reinforces the need to not only consult archival sources and archaeological analysis to understand the deterioration of the building, but also to create detailed records of condition and intervention in the present to inform future practitioners in the same manner. Notably, it is this facet of the recording process that often receives the least attention by archaeologists, who normally only focus on an historical enquiry of the fabric. Therefore, one of the developing aims of this

thesis has been to explore the ways in which buildings archaeology can respond to this shortfall.

The archival research and inspection of the East Front has demonstrated that further light can be shed on the factors which have influenced the alteration of the fabric over the course of the repair history. Although these factors also affect the ongoing deterioration of stonework today, this study has shown that the origins of the issues of structural stability and surface loss lie deep in the East Front's past and that many areas have required renewal and reconstruction on more than one occasion. The easternmost clerestory bay of Area 1, for example, bears evidence of responses to structural movement since the medieval period, while the treatment of the outer turrets also shows that stability in these areas was a concern throughout and immediately after construction. Similarly, contemporary accounts and drawings have shown that the East Front was once intimately surrounded by coal-burning properties as well as flues from the Minster's heating stoves, which would have added significantly to the problem of atmospheric pollution and the decay of the stonework. This goes some way in explaining why the East Front consistently needed repair over the centuries, in spite of its relatively sheltered aspect. More importantly, perhaps, is the recognition of the human dimension in the memory effect that acts upon the façade. The discovery of the extensive use of linseed oil at the Minster as a protective medium and other less-permeable media since at least the eighteenth century brings an added factor to the causes of deterioration, since this is known to exacerbate the problems of salt-led decay in stone (Fenech 2006, 74). This is particularly apparent upon the exterior voussoirs, the clerestory cornices and the carved masonry of the niches, where significant cavitation and loss has occurred (Figures 431-433). Furthermore, as Chapter 4 has shown, the impact of cleaning sulphated magnesian limestone has been brought into focus by this study, and not least by the unfortunate and comparatively rapid deterioration of a number of the voussoirs since their cleaning in the early 1970s. Therefore, the residual effects of atmospheric pollution, the presence of linseed oil-treated stones and the potential effects of aqueous cleaning raises new challenges for the recording and *in situ*

conservation of the façade, which is considered in greater depth below. In the long term, it is clear that a more systematic review and analysis of the effects of cleaning magnesian limestone is required in order to establish a framework in which appropriate and technically-supported methodologies can be laid down.

Regarding rates of decay, the weathering and breakdown of any stone is inevitable over time. However, establishing the rate at which this is occurs may be deemed either acceptable or unacceptable and should be a central consideration when determining whether or not intervention is justified. This level of understanding provided by Chapters 3 and 4 can add to the ways in which rates of decay at York Minster have been estimated in the past. Normally, such efforts have focused on measuring the loss of stone surfaces against protruding dowels or cramps, which would have originally been set flush with the stone. This method can be a useful indicator of attrition in that particular position, although it is common for these modes of loss to be observed in areas exposed to excessive rain-washing, such as weatherings and stringcourses. This can therefore give a false and over-estimated impression of the rate of loss upon the façade overall.

However, the descriptions, drawings and photographs recovered from the archives have all provided additional bases of comparison with which to establish a clearer understanding of the nuances of the material changes taking place upon the East Front. The stratigraphic phasing of the repair fabric of the elevation has been able to further define and emphasise the inferiority of the nineteenth-century stone in general, which has in many situations deteriorated faster than the medieval work. This situation is particularly striking when comparing the masonry of the central buttresses (Areas 2 and 3). Here, it can be argued that the weathering effects upon the repair masonry of the north buttress are more extensive and advanced than they are on the south, while the renewals on both sides have decayed further than adjacent the fourteenth-century work overall. The photographic evidence is perhaps the most enlightening source for enabling point-in-time reference points, which can be used in informing assessments of rates of decay. The photographic archive has

shed much light on all areas of the façade on numerous levels, from perspectives of the entire elevation showing the extensive black sulphation, for example, through to details of areas such as the head of the Area 2 buttress, the seated figure and the carved elements of the numerous niches. All have these have enabled more local assessment and discussion of the rates of deterioration with the Surveyor to the Fabric and Stoneyard during the ongoing re-appraisal of the designs for repair. Likewise, the collective recognition and study of the historic patterns of tilt accumulated since the construction of the façade has been instrumental in the re-assessment of the condition of the Great East window. Since the distortions of the stonework are no longer viewed as new or progressive, a significant shift towards repairing as much of the masonry of the window as possible *in situ* has been decided over the initial view to substantially dismantle and renew (AA/bad/832/02/MINS/04/03/08, 3-4).

So far, this section has placed emphasis on the demand for point-in-time information to inform the decision of whether or not a stone or stones are deteriorating at an unacceptable rate. As a result, the recognition of the special significance of the sculptural programme has meant that the recording remit of this thesis has extended itself beyond historical enquiry into closely documenting the condition of the exterior voussoirs of the East Front using Adobe Illustrator. This survey is guided by the *ICOMOS-ISCS Illustrated Glossary on Stone Deterioration Patterns* (2008) and is provided as Appendix 2. This element of the record will provide a strong basis of information for use by practitioners during the current and future repair campaigns. In the short term, the mapping and identification of decay symptoms will support investigations into the causes of the decay of the voussoirs, which should then inform and justify the methods of treatment and repair. In the long term, the record may constitute the only means of preservation. This has been emphasised by Price (2006, 121), who has recently urged for the closer recording of stonework in its existing condition because it may present the only means of passing the fabric on to future generations. As such, the record *is* the conservation.

In terms of justifying methods of intervention, Chapter 4 has clearly shown that the decay of certain carvings has been ongoing within the current scaffold cycle, and the individual condition maps show that many of the lower voussoirs are now in a significantly fragile state. Carved details are encapsulated in detaching surface skins, and traces of black crusts survive alongside yellow-brown staining from past applications of linseed oil. Surfaces are also powdering, cracking and crumbling. This compounds the urgent case for intervention, and, perhaps, a review of the impact of long-term scaffolding on historic buildings. In the meantime, at least, the significance of the voussoirs coupled with their vulnerable state has ensured that further documentation was achieved by three-dimensional laser-scanning by the Downland Partnership in 2009. Therefore, for the craftsmen of the future, these detailed surveys will provide a thorough record of the voussoirs before intervention, as well as an insight into why certain methods of intervention were deemed necessary. Moreover, in the event of substantial loss of any of the carvings, a detailed account will exist of their previous form, which will then inform new work in the event of replacement.

5.1.2 Cleaning and desalination

This section discusses the impact of the research findings on the practical challenges of cleaning of the East Front stonework as the first stage of conservation. The subject of cleaning historic buildings is both complex and, frequently, controversial (Ashurst 1994a, 1-21). There is often no single reason for cleaning a building, but whatever the motives any cleaning operation should be undertaken on a case-by-case basis with the aim to bring no harm to the surface beneath the soiling. As such, the chosen methodology must therefore be underpinned by a detailed knowledge of not only the history of the stonework but also the soiling and its effect upon the substrate.

The findings of the archival research and archaeological survey have shown that cleaning the stonework of the East Front, and Minster in general, was undertaken as part of the regular maintenance of the building from the

seventeenth century at least. This research has also shown that this was accompanied by consistent attempts to protect surfaces from further decay with oils and paints, as well as lime-based coatings. These practices make a substantial contribution to the understanding of the pathology of the East Front stonework, which raises new questions regarding the desirability of cleaning and the ways in which it might be undertaken. Understandably, the momentum and pressures of the current repair programme has already seen cleaning work undertaken upon the length of the Area 2, the upper sections of Area 3 and the cornices of the clerestories (Areas 1 and 8). However, the enhanced understanding of the past surface treatment of the Great East Window has since been able to underpin a strategy for its conservation (see Appendix 4). Building upon the recognition of the significance of the masonry and carving on both the exterior and interior elevations, this document has provided a framework for further investigation and trials to establish suitable techniques for cleaning and coating removal when necessary. Beyond the Great East Window, the outcomes of this research have shown that it would be hugely beneficial to undertake closer scientific analysis of the soilings and coatings which feature upon the Minster generally. This would better ensure that future surface treatment strategies are continually informed and improved. Indeed, while the rapid alteration of a number of the exterior voussoirs over the last forty years suggests that heavy water cleaning of magnesian limestone poses the high risk of mobilising and re-depositing damaging soluble sulphates, this is still yet to be proven and would therefore strongly merit further study.

With the risks of heavy water cleaning and the recommendations of the strategy for the *in situ* repair of the Great East Window in mind, it has still been possible to refine the methods currently employed for large-scale cleaning work. Since 2008 the TORC™ air-water abrasive system has been used to remove the atmospheric soiling from the surface of the stonework. By combining the minimum of water with finely graded calcite the sulphation is gently removed, leaving the patination of the stone surface beneath intact, and the chance of mobilising substantial amounts of salts much reduced. This approach has been established though a series of field trials on the Area 2 buttress and mullions of

the Great East Window and, at present, is deemed sensitive enough as a method for cleaning large expanses of masonry (David Odgers pers. comm.; Figures 434-437). Importantly, the archaeological analysis of the buttress was invaluable in determining the locations of the trials, so that the responsiveness of the different types of stone to cleaning could be assessed without risking damage to the most important areas of the fabric. The trials demonstrated not only the aesthetic benefit of cleaning to re-assert the nuances of the design, but also the enhanced ability to clearly read the condition of masonry that would normally be obscured by soiling. As a result, this system and programming of cleaning has been introduced for the subsequent areas of repair on the façade, which will undoubtedly be of benefit to the accurate identification and re-scheduling of work as the project progresses

However, such a system may be less suitable for very sensitive work, such as the exterior voussoirs which could lose their outer surfaces under the pressure of the TORC™. Likewise, in inaccessible or delicate areas, or upon surfaces that have shown particular vulnerability to salt-related decay, chemical poultice methods requiring the bare minimum of water have been used to mitigate the potential of salt mobilisation while successfully removing dark sulphation deposits. This has been demonstrated on a number of the canopies of the Area 2 buttress, which have been cleaned with the minimum of water and without any apparent side-effects. In turn, similar methods may be found to be appropriate for the successful cleaning of the carved voussoirs. Inside the East Front, the careful removal of surface coatings from the Great East Window-masonry has been achieved using fine steel blades and the TORC™ system without water. Again, this will enhance the readability of the condition of the masonry units of the window which will continue to inform the specification for repair as new information is revealed.

Alongside cleaning, the need to develop successful desalination strategies for retained stonework is also essential in the long term. Observations at other magnesian limestone buildings, such as Howden Minster and Cusworth Hall, are showing that salts can readily migrate from old to new stonework causing

premature decay (Figures 438-440). This is an unsustainable position if the aim is to extend scaffold cycles at York Minster beyond fifty years (Arrol 2008, 6). Elsewhere, some success with poulticing has been achieved (Hanna and Stancliffe 2001, 19-20), although at other sites attempts to remove salts has only seen them driven further into the stonework (David Odgers pers. comm.). In time, it is envisaged that thinner, bespoke poultice media will form the basis of successful treatments (Eric Doehene pers. comm.). Perhaps most important of all, however, will be the need to monitor and assess the consequences of these interventions over time. This again compounds the need for the creation of detailed records of current work upon the East Front, which is discussed further in the section that follows which deals with the *in situ* repair of historic stones.

5.1.3 Limework and the retention of historic stones

Since the revived use of lime for the *in situ* repair of masonry and sculpture upon the West Front of Wells Cathedral in the 1970s and 1980s, the application of mortars and lime-based coatings has been generally perceived as a tool more synonymous with the conservator than with the stone mason. This has been especially the case at York Minster. However, this analysis of the minutiae of repair upon the East Front illustrates that the practice of 'plastic repair' and surface treatment to decayed stone reaches much further back in time, and was once a seamlessly integral element of the work of the masons. Today, its importance as a component of the conservation toolkit is that it facilitates the desire to retain stones *in situ* and demonstrates that a *practical* attempt has been made to prolong the life of a stone. By following the philosophies and principles discussed in Chapter 1, the findings of this research has helped to establish *why* certain elements are worthy of retention, recording or further investigation. This is the most important starting point of the repair process, as it re-asserts a connection between the craftsperson undertaking the repair and the stone. This leads to a renewed appreciation of what is there, and a satisfaction in being able to extend its life on the building.

Notwithstanding the historical and archaeological research behind the decisions to retain stones *in situ*, there is much that can be gathered from the past to inform the practical conservation process in the present. This research and analysis has shed extensive light on the materials that were used for previous repairs, which, through the process of trialling and monitoring, can support the design of mortar mixes and surface treatments today. Again, this study has also recognised and implemented the need for detailed documentation, in this case the rehabilitation of carved stone *in situ* using lime (Figures 441-445; see Appendix 3). This format of documentation has since been approved by the Surveyor of the Fabric and the Stoneyard (AA/bad/832/02/MINS/01/07/08, 5) and will provide a clear basis on which future practitioners will be able to identify and assess the performance of the repairs over time. Crucially, this will enable any successful methods to be closely replicated and will help to relieve that common frustration of not being able to accurately establish 'what was done when', an aspect of conservation that has so-often troubled practitioners in the past (Rodwell 1996c, 125).

To illustrate how this research has informed the approach to limework, Figures 446 and 447 show examples of historic lime-mortar repairs identified at high level within the central vessel of the façade and the Area 2 buttress. Some are simple patch repairs and others attempt to maintain detailing. In both cases, the mortars are no more than the same coarse pointing mix used throughout, yet the findings of the archival and archaeological research show that these lime repairs are likely to date from the 1820s at the latest. As such, their very survival challenges the view that lime-based methods lack longevity – on the contrary, these repairs have actually outlived many stones upon the façade. The reasons for undertaking *in situ* repairs in the past were probably very different to those of today, being driven by expediency rather than conservatism. However, the question of suitable materials has remained the same, as has the aim to prolong the life of the stone. Importantly, these examples show that the progression of the decay that was being treated has been suppressed, and, as a result, the desire to emulate the composition of these comparatively straightforward mixes for use on the East Front has since increased. Therefore,

the close recognition of the minutiae of repairs throughout the archaeological survey has not only validated the use of certain methods for the *in situ* repair of stones, but also aided the design of the mortars used.

This move towards a simplification of methods and an emphasis on the function of a mortar repair over its appearance has also been supported by a suite of surface treatment trials currently being undertaken upon the severely decaying masonry of the Chapter House of Howden Minster (Pinchin et al 2008; Holton 2009; Figures 448-450). These treatments strongly complement the developing techniques at York Minster and incorporate lime-mortar repairs, as well as lime sheltercoating and surface consolidation using Hydroxylating Conversion Treatment (HCT). The composition of the mortars currently being tested at Howden were themselves informed by the texture and appearance of the historic repairs at York by the use of coarse sharp sands and stone dusts. Emphasis was placed upon investigating the performance of different binders, namely calcium and magnesium putty-limes and feebly naturally hydraulic lime (NHL2), which were also used for the sheltercoats. In particular, the testing of magnesium lime was prompted by a wish to determine whether or not such mortars present a more compatible and authentic option for *in situ* repairs, given that the medieval and post-medieval documentary sources indicate that lime derived from magnesian limestone was undoubtedly used in the past. Of equal importance has been the opportunity to test the view that magnesium-lime mortars may actually contribute to the decay process (Cultrone et al 2008, 750-751). Preliminary observations after six months have shown that this may well be the case, with ongoing decay and increased volumes of surface salts observed adjacent to areas repaired or re-pointed with magnesium lime (Figure 451). Importantly, these preliminary observations also add a further layer to the pathology of the stonework. The archival evidence has demonstrated that magnesium lime was used for not only the construction of the building, but also its repair until the late nineteenth century.

Of perhaps greater concern, however, has been the rapid failure of the NHL2 mortar repairs in this context (Figure 452), not least because hydraulic lime

mortars form a staple component of repair specifications for magnesium limestone for rebuilding, pointing and mortar repair work. In fortunate contrast, however, the treatments based on calcium lime have performed well so far, and as such have led to refinements of *in situ* repair practice at York. The questions raised by this thesis in regard to historic material performance have also prompted further doctoral research by Rachel Walker at Cardiff University, which will undoubtedly aid the prescription of *in situ* repair techniques even further.

Protective coating trials using a variety of organic and inorganic binders have also been implemented upon the East Front to develop a more informed and material-specific approach to the surface protection of old and new stonework (Hall 2008, 56-58; Figures 453-457). This initiative was presented at a Magnesian Limestone Project meeting in November 2007 and has since been recognised by English Heritage and the Cathedrals Fabric Commission of England. It has also been included as one of the key fabric research strands of the CMP (Alan Baxter 2009, 212; see section 5.2 below). The trials include the resurrection of the quicklime-ochre and linseed-oil media documented in the archives in order to create a modern index of past treatments, as well as experimentation with traditional coating ingredients recorded in Standage's (1893) *Cements, Pastes, Glues, and Gums.* Of particular use has been the re-application of linseed oil to sections of the test area as this has enabled more positive identification of areas historically treated with linseed oil, such as the carved voussoirs (Figure 458). The effects of using linseed oil have also been noted within the trial period, where the tendency for soiling to adhere to the coated surface has been especially noticeable. Ideally, future research should be directed towards indentifying suitable techniques for the reduction and removal of linseed oil coatings wherever possible so that their contribution to the attrition of important stonework is actively reduced. Of the lime treatments, those incorporating quicklime appear to have been the most resistant to weathering, and it is hoped that the reintroduction of quicklime techniques for the surface protection of this stone might be considered in the near future.

Varying the thickness and number of coats to a particular stone are further variables that would merit further experimentation.

5.1.4 Stone renewal

Three topics fall under the heading of stone renewal which again illustrate the impact of this study on the direction of the repair of the East Front, namely the sourcing and selection of new stone, the contribution of research to maintaining the design, and the documentation of the processes of dismantling and re-building.

The analysis of past practice presented in Chapter 3 shows that there was once widespread access to suitable building stone for the construction and repair of the Minster, as well as the many other magnesian limestone buildings of the region. Sadly, however, this is no longer the case. Of the many quarries that once operated only a handful remain open, and of those only two quarries offer genuinely good building stone at present. These are the quarries of Highmoor, near Tadcaster, and Warmsworth, near Doncaster. At the same time, extraction at Warmsworth is almost entirely directed towards the overseas manufacture of glass, with building stone quarried only sporadically and in relatively small quantities. As a consequence, Highmoor quarry is the only site devoted to the supply of dimensional stone. Unsurprisingly, the inevitable competition for material has served to increase costs and obstruct steady supply. This has led to a renewed effort to obtain a new source of building stone for exclusive use by the Minster.

Since 2007 investigations have been underway to identify a new quarry site (Jefferson 2007). These important analyses have included historical research[15] alongside petrographic analysis of existing York Minster stone from the East Front and samples from the quarries of Highmoor, Stapleton, Warmsworth and Huddleston. Set against its strong fifteenth and nineteenth-century reputations,

[15] Early results of the archival analysis presented in Chapter 3 contributed to this process.

the site of Huddleston quarry was chosen for further extensive borehole testing with a view to establishing a suitable source of stone according to the selection criteria set out by English Heritage (2006, 9). This concluded that an area to the immediate north-east of the quarry was an area of strong potential for extraction. However, the findings presented in Chapters 3 and 4 of this thesis have been able to raise important questions regarding the current viability of re-opening Huddleston quarry, where the archival evidence of the stone sourcing initiatives of Sir Bernard Feilden in the 1960s and 1970s, twinned with the detailed phasing of the fabric, has been found to be invaluable. The realisation of the difficulties encountered in extracting suitable stone in Feilden's time, alongside the poor condition of the 1840s and 1850s Huddleston work on the East Front (which has significantly overtaken the rate of failure of earlier stonework), has challenged the perception that Huddleston remains a suitable source for stone for repair. This has also been enhanced by the fact that, alarmingly, Huddleston renewals from the 1970s continue to decay (Figures 459 and 460). In addition, because the criteria for selection normally focus on achieving durability without the consideration of the craftsman's view and workability, the value of Huddleston as a possible resource has since diminished further. Indeed, despite the presentation of numerous samples from across the site, not one has proved to be suitable for working by hand.

Having been informed by these findings, the prospection for a new source of magnesian limestone for the Minster is now being aimed elsewhere. While the findings of this study may not have solved the challenge of identifying a new resource for the cathedral, they have at least averted the expense (both financial, and, in the longer term, material) of embarking on a new quarrying operation that will only appear to yield unsuitable stone in practice. This highlights the need to carefully note the performance of stone from different dates and quarries *on the building*, to consult the recent past, and to incorporate the views of the craftsman and buildings archaeologist when prospecting for a new source of stone for repair.

A further benefit of the new dialogue between buildings archaeology, the Minster craftsmen and the process of renewal has been the close reading of the fabric to inspire design. Until recently, it has been common practice to inform new carving with the most readable examples of the old in order to maintain continuity in the design. In most cases this is based upon nineteenth-century work or later, with the inherited view that the previous carvers had conscientiously copied what had come before. However, the research and analysis presented in Chapters 3 and 4 has been used to demonstrate that although nineteenth century carvings incorporate elements of the medieval design, they are frequently simplified. This is especially the noticeable in the restoration work that followed the destruction of the choir by fire in 1829. A number of factors are likely to have contributed to this, including financial constraints, the quality of the stone used and the pressure to renew a considerable amount of the building. This leads to a danger of responding to and maintaining overly-simplified restoration detail, which in turn fails to convey an authentic interpretation of the intended medieval design. This aspect of the philosophy of repair is an important one to tackle, as it is often the underlying (and in many cases legitimate) motive behind renewal. Importantly, it is also an aim that is not only relevant to the masonry of the Minster, but its medieval glazing as well.

One of the impacts of the engagement between buildings archaeology and the masons and carvers of the Minster Stoneyard has therefore been a greater questioning of the suitability of certain motifs, and the value of the primary carvings and historical information as sources of inspiration for new work. In spite of the obvious effects of weathering, the process of cleaning and recording has drawn attention to the intricate detail of the original fourteenth century work on the façade. Combined with analysis of the interior, this has lead to the successful re-assertion of the medieval motifs, rather than the nineteenth century examples. Notable examples include an Area 2 niche pedestal and the renewed clerestory cornice of Area 1. The new pedestal carving responds to the nuances of its medieval counterparts both inside and out, instead of merely replicating the sharper examples of the adjacent nineteenth century work

(Figures 461-464). In the case of the clerestory cornice, this evolution in approach can be marked between the easternmost bay of the north clerestory renewed in 2006 and the work to the subsequent bay to the west completed during 2008. To the east, the fleshy leaves of the cornice respond to the 1830s restoration work, which was simplified and repetitive (Figure 463). By the time work to the western bay was underway, however, a section of original leaf carving, complete with its Perpendicular volute, had been identified in the Minster's stone store. This motif was carefully reintroduced into the design to present a more authentic and aesthetically pleasing version of the cornice that was not based on conjecture but on sound evidence (Figure 464). This clearly conveys the value of researching the details of the building to inform new work. Moreover, this also highlights the potential contribution that could be made by a permanent lapidarium at the Minster during the ongoing process of renewal. Rather than simply acting as a repository to serve the academic study of redundant stones, such a resource could play an active role in the accurate and well-informed maintenance of the Minster's design.

The value of understanding and using the building to inform new work extends further still. In view of both the significance and vulnerability of the exterior voussoirs, new carved work has sought to encapsulate and sustain some of the detailing and key elements of the east window's iconography. As part of the renewal programme at the head of the Area 2 buttress, the decorative corona was designated for full replacement. A theme of 'ailments' was prescribed for the grotesques of the corona to guide the subject matter of each carving. In turn, Uzziah, a King of Judah who died of leprosy around 740BC, was chosen as a subject for one of the carvings as a link to the kings surrounding the east window (Figure 465). The piece incorporates details from the original carved work, as well as the glass, along with the themes of the Lion of Judah and the foliage of the family tree. In order to capture the leprosy ailment, careful water traps were carved into the figure so that the grotesque will slowly develop its affliction through the process of decay over time.

The renewal of the Area 2 corona has also seen the introduction of a representation of Edward of Woodstock, the Black Prince and son of Edward III, who died in 1376 (Figure 466). Since the Prince had suffered with dysentery the reason for his inclusion in the work is superficially obvious. However, underlying the carver's choice of subject was the fact that the Prince's colourful life ran parallel with the rebuilding of the east end. According to Hughes (1988, 133) Archbishop Thoresby is known to have ordered prayers for the Black Prince during the fourteenth-century wars with France, with the Prince eventually commemorated in the Lady Chapel by means of a shield and bust. Taken together, these carvings illustrate an informed response to a theme laid down in the present that is also able to acknowledge the details, meaning and historical associations of the East Front. This can be viewed as a process of creative conservation, which actively re-asserts the significance and qualities of the building through the creation of new forms.

As Chapter 1 has outlined, the renewal of carved work and statuary has been considered within the East Front repair proposals from the outset. As such, the findings of the archival and archaeological analysis of the East Front could be implemented further by supporting the reinstatement of the carved leaves of the Great East Window and the donor figures of Percy and Vavasour within the outer niches of Level A, which had been unfulfilled intentions in the nineteenth century. This would provide an opportunity for new carved and sculptural work to be undertaken that could, in the case of the statues, be guided by the antiquarian descriptions and drawings, their heraldry, the evidence of their previous fixings, and the broader histories of these families and their associations with the Minster. In this sense, the important theme of donation shared between the stonework and the glazing scheme would be revealed and reinforced once more. The introduction of contemporary donor images could also be tentatively considered for the remaining Level A niches as an extended acknowledgment to the funding of the current repair programme and the significant theme of donation.

One of the legacies of this study has been the benefit of developing a closer relationship between research and analysis and the process of dismantling and rebuilding a substantial part of the East Front. The results of the archival and archaeological survey have been able to define the continued attention of the masons of the past to the weathering and structural complications associated with the East Front. Chapters 3 and 4 have shown that repeated replacement and re-setting of the masonry at high level took place, showing that the needs of the current repair programme have strong historical precedent. The ability to record the work of dismantling and re-building has been both crucial and enlightening, showing that the new corona currently being fixed is the third, if not fourth version. Indeed, the present renewal of the corona is the continuation of a tradition and need in this case, as well as the design itself and the craft skills and technologies that are required to do the job. As such, the act of seeking to understand has been able to both reconcile and facilitate change.

A unique aspect of this study has therefore been to continue the process of learning and recording, as dismantling and rebuilding has progressed. As Sampson (2006, 69) observes, it is unusual for a buildings archaeologist to be present throughout the course of repair work. However, when dealing with a building such as the Minster whose architectural evolution is reasonably well understood, it is these moments of extensive repair which offer some of the best chances to add to our understanding. The development of a close working relationship with the head fixer-mason has been crucial to the co-ordination of analysis, discussion and documentation of the archaeology of the head of the Area 2 buttress discussed in Chapter 4. The true evolution and complexity of this part of the fabric has been revealed, shedding new light on its history and the reasons for its unusual design. In addition, the frequent dialogue between archaeologist and craftsman has been invaluable throughout the conservation process, with each discipline learning from the other, while the stages in repair have also been closely recorded for the benefit of current and future practitioners. Indeed, in the short term the knowledge gained from the Area 2 project is already helping to inform and revise the strategy for the repair of Area 3.

In sum, this section has illustrated the clear benefits of detailed research and analysis before and during the practical conservation of the East Front. The proactive impact of an intimate understanding of the façade has been presented. Rather than being an inhibitive process, the assessment of significance alongside the condition and nature of the materials of the building is able to support practical action from the superficial cleaning of the surface of stones to *in situ* repair and, finally, renewal. Importantly, this highlights the necessity for detailed recording and documentation, which has also been sustained throughout. With the fabric of the Minster in a state of constant evolution, the integrity of the account of this change in the present will have a direct bearing on the integrity of decisions made in the future. As such, the contribution of this thesis to the care of the cathedral will perhaps be made even clearer in fifty years time than it is at present.

This chapter has reviewed the direct advances made through the presence of buildings archaeology, and a desire for a more informed approach in general, within a major programme of repair at the Minster. The final section of this thesis therefore seeks to re-visit the tensions presented in Chapter 1 to consider whether or not such issues have been adequately addressed, and how the current philosophy of repair might be reshaped to balance the global criteria of conservation and recording with craft practice and technological needs of the building.

5.2 The future of conservation at York Minster – towards an integrated approach

At first sight, the focus of this study on one element of York Minster may appear somewhat narrow. However, as has been shown throughout, the close analysis of the fabric combined with the rich contextual information delivered by the archives has provided a valuable lens through which broader questions regarding the archaeology and conservation of the cathedral, and magnesian limestone buildings generally, can be challenged. In particular, the intimate knowledge of the repetitive, cyclical pattern of repair upon the East Front and

the techniques and materials used is especially relevant to the conservation debate and the current attitudes to repair today. In the case of the buildings archaeologist, who might normally be preoccupied with the significance and retention of the physical fabric alone, an explicit understanding of the frequency of change coupled with an understanding of the materials and their vulnerabilities can re-configure the attitude towards intervention and renewal. Importantly, many elements of Chapter 4 have shown that it is the very act of stone replacement that enriches the archaeology of a building, as well as providing fresh opportunities to investigate the fabric and shed new or revised light on its past. Moreover, if action is to be underpinned by the aim to sustain significance and values, there must be a place for the maintenance of the architectural design within the conservation process, since this is a fundamental quality of the Minster so often celebrated since the days of antiquarians. Indeed, the suppression of stone replacement at York Minster would be an attempt to uncouple it from its inherent trajectory and heritage.

Equally, due regard must be given to the conservation of craft skills and repair technologies as part of the process so that the cathedral continues to be traditionally maintained using appropriate methods and materials. The deviation from such practices has demonstrably led to dire consequences in the past. This includes the introduction of hard cements, incompatible stone types and the virtual collapse of the workforce and the backlog of repairs that accrued in the wake of two World Wars. However, while it is right that the replacement of stone and the maintenance of design should now rank equally amongst the other well-established components of practical conservation, this is not to say that there is no place for the recognition of significance and the retention of historic stonework where appropriate. This underpins the need for research and recording all the more, so that repair is both informed and mitigated. Indeed, if sufficient investment had been paid towards understanding the exterior voussoirs at the planning stage of the East Front project, their exceptional importance would have been recognised from the outset and measures implemented to record and protect them much sooner. Instead the

carvings have continued to decay, and have been exposed to an altered environment to which they would not normally be accustomed.

The analysis of historic craft practice at the Minster through not only the archival research but also the archaeological survey has also supported a new dialogue with the masons and carvers of the Stoneyard to explore the craft tradition more critically. As Chapter 1 has outlined, a latent tension has existed for some time between archaeology and conservation on the one hand and established craft practice on the other. At the heart of this lay the view that conservation was only concerned with the retention of historic stonework *in situ* and that the traditional remit of the mason or carver lay solely with renewal. However, the findings presented in Chapters 3 and 4 clearly demonstrate that, historically, the complete care of the building lay with the Minster craftsmen, who routinely undertook tasks which would now be considered to be techniques of conservation. These tasks included cleaning, applying protective coatings and the consolidation of decayed stones with lime-based repairs, as well as renewal. Furthermore, the archival analysis has shown that the workforce was, until comparatively recently, governed by the seasons, that scaffolding tended to be more fluid and localised, and that the masons were also capable of manufacturing and processing materials, such as lime. This reinforces the idea that the workforce was once equipped with a suite of sustainable skills to *holistically* maintain the cathedral. As such, it is only since the development of modern cements (which enabled working all year round) and the migration of *in situ* repair techniques in the last forty years to the realm of the conservator that this position has changed. This has left practice at the Stoneyard focused mainly on replacement. Thankfully, however, this situation has already been evolving as the East Front project has progressed. By continually exchanging knowledge with craftsmen, an acceptance of cleaning, limework and renewal as elements within the palette of options has grown, with the development and training of *in situ* repair techniques within the Stoneyard now underway and a desire amongst many of the masons to reinstate on-site lime production (David Lamb and John Sutcliffe pers. comm.). Furthermore, the use of lime for re-building has seen greater appreciation, and

with this an enhanced understanding of its working properties. In turn, this has seen a shift back to seasonal working, with work focusing on the working of stone during the winter months. Significantly, this knowledge exchange has extended to the *Cathedral Fellowship Scheme*, where the involvement of the author at the 2009 York Symposium enabled the approaches to understanding and conservation to be shared with cathedral apprentices from other UK cathedrals.

Importantly, the stance of both buildings archaeology and the craft practice at York has seen the definition of conservation broaden exponentially beyond the mere retention of historic stonework *in situ.* Indeed, the value of investigating the history and architectural elements of a building to support the process of renewal and the re-assertion of the design has become universally recognised. This has served to strengthen the relationship between the archaeologist and the craftsmen and the building, which has seen its significance strengthened and conveyed in new, creative ways. As this chapter has illustrated, instead of simply holding the design in stasis by referencing renewals to inadequate nineteenth century restoration motifs, the richness of detail that once prevailed is gradually being reinstated across the East Front, which at the same time pushes the skills of the craftsmen to new levels.

In Chapter 1, it was stated that this research sought to not only enhance the understanding of the East Front and its significance but also to examine the relationship between this understanding and the conservation of the façade. The research outcomes presented in Chapters 3 and 4, as well as this chapter, demonstrate that these aims have been overwhelmingly met. The understanding of the complexity of the elevation has been transformed. This has drawn closer attention to the values embodied within its stones which span the centuries since its construction. The enhanced appreciation of the stones of the façade does not, however, drastically transform the amount of stone that requires replacement. This will forever remain a practical challenge because of the scale of the building and the inherent weaknesses of magnesian limestone as a material. Importantly, however, this study has shown that because of these

issues the need to understand and record is in fact strengthened. In the case of the exterior voussoirs surrounding the Great East Window for example, recording may offer the *only* means of long-term conservation. Furthermore, the importance of understanding the history and understanding of the façade is less as a tool for arguing for the retention of stonework, and more as a support mechanism for developing the chosen methodology of repair based on material considerations. Above all, the transformed understanding of the East Front has begun to inform a new philosophy amongst the archaeologist and craftsmen, which seeks to use a detailed knowledge of the building gained from extensive research as the starting point for every process of repair.

The key issue therefore is whether or not a philosophy of repair can be developed which incorporates both the academic and practical agendas. In other words, is it possible to address the tension between philosophy and practice outlined in Chapter 1, which has been most recently epitomised by Yeomans' (2007) response to English Heritage's *Conservation Principles* (2008)? Admittedly there is always a danger in being over-prescriptive when laying down such a design, since it can introduce preconceptions and cloud the opportunity for assessing and appreciating the fabric case-by-case as found. However, the overriding value of developing a work ethic for a site such as the Minster is that it provides transparency in approach from the outset, mitigating the tendency for ad hoc decision-making and the inevitable conflicts that can ensue. Therefore, the approach to conservation at York Minster is reconsidered here. This approach seeks to acknowledge all of the processes outlined in Section 5.1.

In essence, this approach is very simple: instead of attempting to justify replacement upon the criteria of structural performance alone, it is suggested that stones should be assessed according to their condition alongside their intended architectural function and hierarchy on the building, with any intervention prescribed on the basis of the most appropriate option that will serve to re-assert that function. This tentative model is outlined in Figure 467.

At stage one, the repair design is underpinned by a process of thorough and collaborative research that acknowledges the aims of Clarke's (2001a, 9) CoBRA model, but seeks to lay a foundation of deeper understanding from the outset. As outlined in Chapter 1, the East Front repair programme had inherited a policy of placing historical and archaeological analysis at the mitigation stage of the process (YML/E7/2/6, Appendix D, 1). In practice, this reduced the contribution of this perspective of understanding to the approach to repair. However, as the programme has evolved the contribution of archaeology, and research in general, has been afforded greater emphasis. This has been facilitated not only through the membership of the author to the East Front Progress Group (EFPG), but also the production of a conservation management plan (CMP) for the Minster by Alan Baxter Associates (2009) and the ongoing revision of the Minster's *Current Stone Practice* document (Arrol 2008). Each of these areas of policy seek to ensure that findings of detailed research are absorbed into the proposals for conservation at an early stage.

The EFPG incorporates members of the Stoneyard as well as the Surveyor to the Fabric, and has provided a valuable platform in which to share knowledge and inform the ongoing process of repair. Being able to disseminate knowledge as more information has come to light has been essential to the well-being of the Area 2 phase of work while drawing attention to the value of the archival research and archaeological recording to the conservation process. Importantly, some of the key in outcomes of this thesis have been incorporated into the higher-order care of the cathedral through the CMP. Direct contributions have been made not only to the interpretations of significance found within this document but also the future directions of research agendas and the development of *in situ* repair techniques for stone. Indeed, the CMP cites this research on the East Front 'as a model for future programmes' (Alan Baxter 2009, 210). Section 4.0 of the CMP lays down key management policies, including the need for ongoing archaeological and science-based research initiatives to improve the understanding of the history, composition and significance of the fabric of the Minster, and the nature and performance of its materials, especially stone (Alan Baxter 2009, 197, 205-213). As such, this study

has been instrumental in shaping these requisites, whilst also being an ongoing proponent of them as investigation has continued on the East Front over the past year.

In principle, then, the valuable contribution that research-driven study can make to the conservation of the cathedral is therefore undeniable. Inevitably, this raises the question of how such research can be practically integrated into the process. The key to answering this lies with establishing the careful timing of research with the Quinquennial Inspection regime and anticipating where the need for investigation will lie over the long term. For the most part, this research has run alongside a repair programme. However, as Chapter 1 has discussed, the need to address the problems of the stonework of the East Front has been firmly fixed on the FAC agenda since 1996, if not before, which could have enabled substantial archival research and preliminary archaeological appraisals to be undertaken prior to scaffolding, closer analysis and the formation of the detailed repair proposals. In the future, therefore, it should be made possible to undertake archival research well in advance of scaffolding an area so that detailed research findings can play an active role in conservation without delaying work. Arguably, the preparation of a thorough repair history of the entire Minster would be advantageous so that the reactionary nature of research would be even more reduced.

Therefore, to further encapsulate the findings of archival and archaeological studies in the practical conservation process, detailed research and recording could be integrated with the *Current Stone Practice* protocol as follows:

- **Quinquennial Inspection –** long-term maintenance schedule consulted to inform direction of archival research and reconstruction of repair history; background art-historical, archaeological and historical review
- Scope of work identified ahead of repair, *Statement of Need* prepared
- Further research, including templet collection, plaster casts and Lapidary Collection

- Survey drawings produced (e.g. photogrammetry, rectified photography)
- Scope of work etc. re-visited, scaffold erected
- Archaeological and geological survey, including detailed photographic survey
- Condition survey, including detailed mark-up of areas identified through research as especially significant
- Analysis by structural engineer
- Soiling and coating surveys
- Mortar analysis
- **Disseminate research**

In turn, this would support the following approach to repair:

- Stage 1 Specification defined by Head Mason, Conservator and Surveyor to the Fabric with research outcomes in mind. Consultation with archaeologist.
- For large and complex projects, consider repair sequence incorporating an understanding of *both* condition and significance
- Establish *in situ* repair methodologies (e.g. cleaning if necessary, and mortar repairs) through on-site trialling
- Clean building, record results
- Review and refine Stage 1 spec in light of any new information post-cleaning
- Undertake repairs – record during work
- Sheltercoat whole
- Final photographic record
- Deposit project archive at the York Minster Library and Archives
- Monitor work and agree priorities for periodic localised maintenance

To return to Figure 467 at the repair stage, the purpose of arranging the treatment of stones according to their type is an attempt to address the increasing trend and associated problems of retaining individual stones according to purely structural criteria, rather than intended function.

Importantly, this is not a criticism of any individual or discipline, but simply a response to a global situation that has evolved as a result of the stand-off between conservation and restoration in the traditional sense. This has lead to the frequent practice of retaining a scatter of historic stonework amongst swathes of renewal. On the one hand, this is often derided as a token gesture towards conservation. On the other, the complaint from the craftsman's perspective is that the design and capabilities of the craft appear undermined.

This is typified in the case of the repairs to the head of Area 2. To demonstrate that an effort has been made to save material, portions of heavily weathered, though structurally sound, stringcourse have been retained (Figure 468). The historic integrity of the structure has been lost through the necessary process of dismantling, and so the sole value of such stones is as an archaeological reference to justify the form of the adjacent renewals. However, the technical and practical implications of leaving such stones, as well as deeply recessed historic ashlars amongst new, are likely to cause problems in the future – a situation that no discipline would normally be satisfied with. In the example shown in Figure 468, the function of the portion of stringcourse is as a service stone i.e. an element intended to aid the water management of the building. However, this stone is no longer performing its function in this case, having lost its drip-moulding through weathering. This will cause water to affect the ashlars below, including the new work. The inevitable differentials in distance between the old and the new work lead to the formation of ledges, which can subsequently act as water-traps. Furthermore, the retention of the heavily weathered ashlars amongst substantial renewal means that these stones may require attention sooner than the adjacent work in the future. This could lead to premature disruption of the masonry to gain access to these elements to facilitate renewal. While it is possible to flaunch off-set edges with lime, such mortars are not normally very durable when used in this way and so their long-term performance as water-shedding elements cannot be guaranteed.

The view adopted here, therefore, is to propose a structured approach to stone repair based on an appreciation of function *and* condition, with the selected

repair method being the most technically-appropriate option that will see that function re-asserted. This can range from cleaning to full replacement with different ranges of options considered depending on the position of the stone within the hierarchy shown in the diagram above. At the base of the order are the service stones of the building, which serve to manage the transport of water to the ground and protect the surrounding elements. Here, emphasis is placed on replacement, for the maintenance of these stones stands for the good of the adjacent masonry. Next come the structural elements, such as ashlars, buttress flyers etc. which form the main body of the building and afford it stability. Again, the maintenance of these elements contributes to the well-being of the building overall and the renewal of these elements, where necessary and in whole or in part, should not be lamented. Next comes the repetitive masonry elements that serve to articulate and assert the design of the building overall. These include mouldings, crockets, etc. and, importantly, can be maintained either through *in situ* repair methods or renewal depending on their position and condition on the building. Above these elements come the carved and decorative stones, such as canopies, pedestals and grotesques. Here, an emphasis on underpinning research should be maintained, with *in situ* repair options thoroughly explored before replacement. Finally, at the summit of the hierarchy are those stones which were intended to convey a specific message, such as niche statuary or, as in the case of the East Front, the carved voussoirs. The treatment of such elements requires extended research and an emphasis on retention *in situ* before replacement is accepted, but, importantly, not outruled.

This model can be considered in the context of the sculptural ensemble of the Great East Window. As this thesis has shown, these elements are both highly significant as well as being in a deleterious condition in many cases on the exterior. While the renewal of certain carvings would be suitably informed by research, the practical implications of removing individual voussoirs would be complex, and could threaten to disrupt the integrity of the voussoirs that were to remain. Moreover, if the extant voussoirs were retrieved intact, the question of their suitable storage would then arise owing to the fact that the Minster does not currently have a dedicated lapidarium. This has been borne out in the case

of the carved voussoirs of the Great West Doorway. These internationally significant carvings were removed on the grounds of ensuring their preservation. However, insufficient action was taken to create a suitable means of storage and presentation and the voussoirs were initially stored in various unsuitable locations (Godfrey 2005, 60; Figures 469-470). More recently, this problem has worsened with further transport and separation of the voussoirs due to increased demands on the current storage facilities. As such, while the new Great West Doorway itself may be deemed a success (Wood 2008, 8), it remains questionable at present as to whether or not the core aim of the renewal programme was met.

Precedents for *in situ* limework on the East Front, both in the past and in the present, have already been presented in the course of this thesis. Similar techniques could be applied to the voussoirs and sill carvings, including the re-assertion of form, which would enable the subjects to still convey their message intact. Crucially, a detailed recording regime would see an archive of information handed to the next generation of practitioners. This would ensure that when the opportunity and necessity to renew any carvings arose, perhaps when the Great East Window eventually requires dismantling, a corpus of information would be to hand to inform the work. This brings us to the delicate question of the future of the seated figure, which, at the time of writing, is still to be decided. Based on condition alone, a strong case can be made for the repair of the figure *in situ.* Indeed, there are many other stones at high level in a more severe condition that have been designated for retention using lime, and historic practice has shown that localised scaffold access can be implemented to ensure intermittent care between major repair campaigns. The question here is more to do with meaning and design – does the seated figure still fulfil its intended function? At distance, from which the figure is normally viewed, the statue is still readable as a seated, mitred figure. If the suggestion that it is to represent St. Peter is accepted, then it could be argued that the statue still performs its function and should stay. However, taking into account the iconographical and archaeological analysis, this may not be the case. With the importance of the message of the glazing in mind, should equal credence be

paid to re-asserting a clearer interpretation of the meaning of the statue? In truth it is not for one person to provide a definitive answer. This emphasises the need for collaboration and a balanced debate to acknowledge all views and ideas, and it is at this point that the job of the buildings archaeologist is done. If the opportunity to gather and present information on an item such as the seated figure is facilitated, then the process is duly informed and a transparent decision can be made. Importantly, however, the lack of a definitive identity for the figure should not be negatively used to obstruct replacement – after all, stone is a natural material and sooner or later the decision to replace the figure, like any other stone, will have to be taken.

Of course, what may be appropriate at York Minster may not be so desirable, necessary, or affordable at a small parish church or ruin, and this reinforces the case for that sound platform of understanding, transparency and need to be established from the outset. York Minster has a reputation for replacement, some would say over-replacement, but it has only earned that from the needs of the building itself. The sheer scale of the structure means that major scaffold cycles are protracted, and replacement proportionately more obvious. The fact that magnesian limestone suffers from a volatile decay mechanism must also be brought into the equation. This should not, however, outweigh intermediate maintenance of areas that are easily accessible, as history has also shown that while a substantial gap may intervene between major repairs, basic cleaning, re-pointing and monitoring can take place within each hiatus from localised scaffolds. As such, conservation at York Minster should be seen as the conservation of a process, absorbing the recognition of the sensitivity of the fabric alongside an acceptance for renewal when the time comes.

5.3 Conclusion

To conclude, this thesis has shown that detailed archival and archaeological research can profoundly inform and influence the process of conserving York Minster. This demonstrates that, when appropriately tuned, the aims and methods of buildings archaeology are entirely compatible with the challenges of

practical conservation. The understanding of the East Front of the Minster has been transformed, and the gradual dissemination of this understanding has supported, rather than restricted, the inevitable force of change. Importantly, this study has revealed the value of the repair history of a building to not only support or question previous debates amongst scholars, but also to develop an extended appreciation of the complexity and value of the fabric and its history beyond its medieval construction. While this study has focused on a single part of the building, it is clear that such a model can be transposed to the remainder of the Minster and, arguably, cathedrals in general.

Like every contribution to research, this study raises new questions and challenges for the future. Some of these relate to policy and the implementation of research, while others are practical and relate to materials. Beyond this study and the conservation of the East Front, it will be important to more closely align any research which seeks to inform repair with the long-term schedule of maintenance as laid down by the Quinquennial Inspection process and endorsed by the CFCE. This includes the development of a detailed repair history for the Minster, either as a cumulative report for each area in anticipation of its repair, or as a holistic study in its own right. The practical challenges of repairing the Minster's magnesian limestone will also continue to evolve, which is strongly relevant to the care of the region's heritage beyond the cathedral. The question of how best to clean magnesian limestone remains open, and is one that should be addressed as soon as possible so that the consequences of cleaning sulphated stonework are better understood. The development of appropriate lime techniques for *in situ* repair is also still in its infancy, as is the understanding of the processes of decay and the sourcing of appropriate stone for renewal. Importantly, progress can only be made through the collaborative input of all related disciplines from archaeologists to craftsmen. With the building as the guide, it is only through this collaborative relationship that its conservation can be deemed successful. If the outcomes of this thesis could be gathered into a single phrase, it would be that we must constantly look back to look forward.

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YML/3/9 – Full size drawing of a ?console, East Front. ?Wm. Shout, early nineteenth century.

YML/3/10 – East elevation of the turret at the south east angle of York Minster. Turret and Spire NE and SE angles East End (on rear). ?Robert Smirke, 1837 and 1838 (1835 crossed out).

YML/3/11 – Elevation drawing of the top of the ?N buttress. ?Sydney Smirke, mid-nineteenth century.

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