

London Crossrail: The New Churchyard AD1569 to AD1714

Archaeology investigation and dealing with mass exhumation

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Abstract: In AD1569¹ a new burial ground was set out in the north of the City of London to cope with the ever increasing demands for burial space within the local parishes. Increasing population, together with 16th century disease epidemics had created an urgent demand for more space and the new metropolitan solution for large extra-urban cemeteries in the suburbs was still some 300 years away. The Bethlem Burial ground, an acre of land adjacent to the infamous hospital, operated for some 200 years. During this time many thousands of interments took place, mostly in simple wood coffins or shrouds, and exceptionally in family brick tombs. When it was discontinued the land was raised sufficiently and the cemetery disappeared from trace below new street layouts and buildings of the Georgian urban housing boom. In the mid-19th century (1861) the construction of the new Broad Street Station and underground ticket hall in the northern part of the cemetery no doubt came across human remains, but in the spirit of the day, there was insufficient notice taken to halt or alter the works. In 1985, development again struck the northern part of the site during redevelopment of the station to create London's largest new business district at the time, the Broadgate Centre. This time, archaeologists from the Department of Urban Archaeology at the Museum of London were able to carefully excavate a sample of the burial ground. The final phase of the depositional history of the site is now being played out in advance of construction of the new Crossrail underground ticket hall which will remove the remaining undisturbed southern part of the burial ground. This paper will look at the ²historiographical background to the current research, the planning issues surrounding choices in research agenda, methodology, public relations and reburial of the remains.

Keywords: London; Crossrail; Liverpool Street; Burial Ground; Exhumation; Archaeology

Introduction

London's Crossrail project is a brand new suburban rail service connecting west and east London surface rail by constructing 21 km of new sub-surface twin rail tunnels under the center of the city. This paper is focused on one particular station, the new Crossrail ticket hall being constructed at Liverpool Street in the City of London corporation area in the United Kingdom (Fig. 1). The construction of the new ticket hall coincides with the historical location of London's first extra-parochial burial ground. It is known variously as the New Churchyard; the Bedlam or Bethlehem Churchyard; and later as the Bethlem Burying Ground, as

¹ All subsequent dates are calendar AD

the land was once a tenter ground belonging to Bethlehem Priory Hospital, London's first institution for the mentally ill. The English word Bedlam, meaning 'noisy uproar and confusion', stems from the place in which the hospital was first established in the Priory of the Order of St Mary of Bethlem just off Bishopsgate to the north of the City of London medieval wall (Fig. 2). The priory was founded in 1247 and from around 1330 it was referred to as a hospital in historical documents.

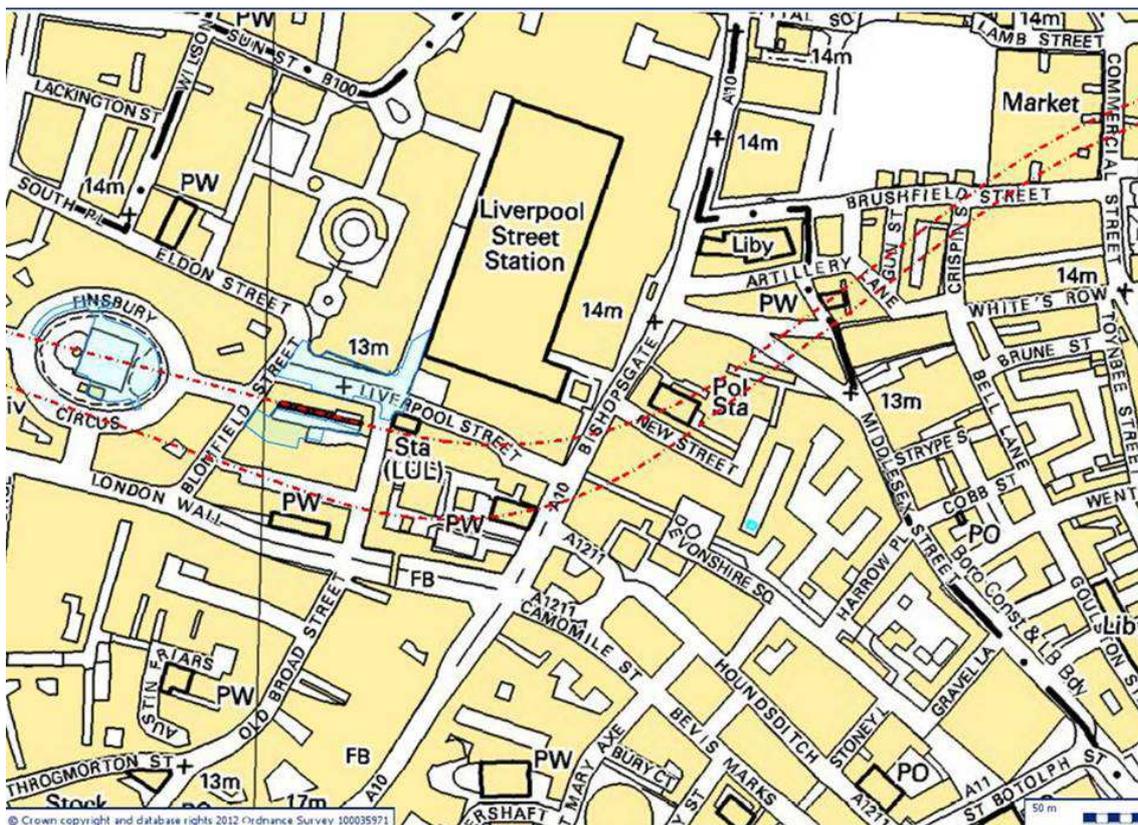


Fig. 1 – Location Map. The blue shaded areas on this and subsequent map extracts below are the locations of the Crossrail construction worksites at Liverpool Street Station overlaid. The Crossrail tunnels are indicated by the red dotted lines (Copyright: Crown Copyright used with permission of Ordnance Survey license 100035971)

This paper looks at the historical development of the site and some of the key events in its rediscovery in the centuries since it went out of use. The paper then looks at the treatment of the surviving skeletons over a period of 150 years, and some of the archaeological and ethical issues that we are dealing with as we carry out what is likely to be the final phase of investigation of the site.

Founding of the burial ground and historical development

The New Churchyard represents a significant shift in burial practice in the city. It was the very first of the early modern non-parochial churchyards (HARDING 2002). That is, burial grounds that were set up outside of the strict confines of a local parish church. By the mid-16th century, burials in London's city churchyards and in particular at St Paul's, had been so numerous that; 'scarcely any burial could be made without corpses being laid open!' This prompted the Lord Mayor (Sir Thomas Rowe, Lord Mayor from 1568 to 1569)

to issue an order that parishes were to use the new Burial Place provided by Rowe (the Bethlem Ground) or to make or buy new spaces for themselves (ibid.)

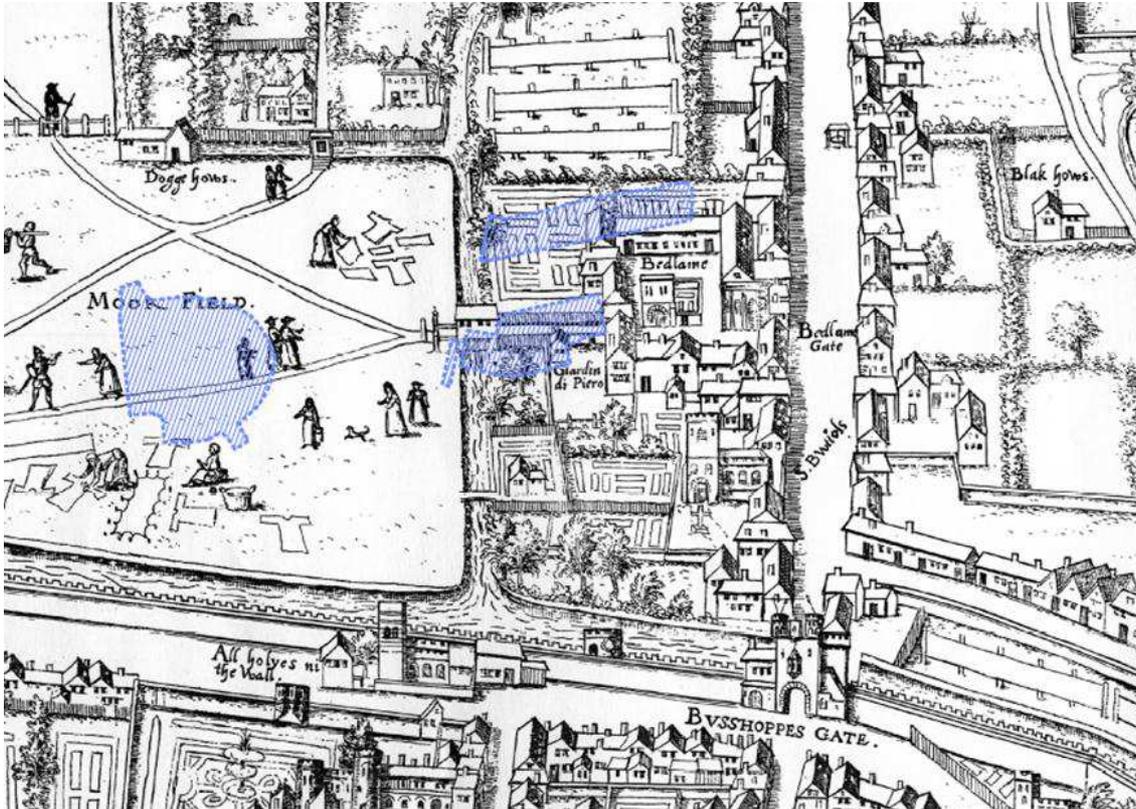


Fig. 2 –Extract of Agas Map of London 1553. The tenter grounds are indicated to the east and north of the priory buildings (Copyright: None)

The two hundred years between 1500 and 1700 saw London's population grow to half a million, four times what it was estimated to be in 1550 (HARDING 2001). This period is characterised by a growing population, generally low building standards, lack of sanitation in the poorer districts and recurring disease epidemics—influenza, cholera, typhus and bubonic plague. These factors combined are thought to have produced high death rates generally and in particular high infant and sub-adult mortality. Plague outbreaks are recorded in 1563, 1593, 1603, 1625 and 1665. In 1563 around 17,000 people are estimated to have died in the city, one of the worst events in the early modern period (HARDING 2007), and it is in response to that devastation that a one acre plot of land belonging to the city was walled in at Rowe's behest in 1569 (Fig. 3).

As an extra-parochial burial ground there is no single burial register in existence. Rather, burials in the New Churchyard are recorded from across London in the local parish registers. Unlike the city churchyards, burial fees were reasonably low or waived altogether and the ground soon became a resting place for the poor, dispossessed and marginal members of society. Harding's (1993) research tells us that servants, strangers, suicides, religious non-conformists, the unclaimed bodies of former prisoners and plague victims represented a typical profile of those buried in the New Churchyard in the 16th and 17th centuries.



Fig. 3 – Extract of Fairthorne and Newcourts Map of London 1658. 'Bedlame' marks the walled in burial plot with gateway on the south side (Copyright: None)

However, the burial ground was also used by better-off families and gained a reputation for use by separatists, dissenters and advanced Protestant and non-conformist communities from across the city. For example the executed Leveller in Oliver Cromwell's New Model Army, Robert Lockyer, was buried at Bethlem in 1649 (HARDING 2002). Lockyer had been shot by firing squad at St Paul's cathedral for mutiny after refusing to leave London as ordered in a dispute over pay and orders. His funeral attracted 4,000 people to the 'New Churchyard'.

The disease epidemics of the 17th century no doubt led to overcrowding of the New Churchyard and in 1665 orders were given to cease further burial and 'cover the ground with a layer of fresh earth to suppress the stench and annoyances, and cover the bones laying above ground and burn the pieces of coffin boards lying around!' However burials did continue and records show that after 1665 the gravedigger at the New Churchyard, formerly so hard at work, was able to stop digging mass burial pits and return to burying in single graves, some of them clearly well off family groups using lead coffins in brick vaults (HARDING 1993).

We can see these historical testimonies reflected in the archaeological data (Fig. 4). The earliest phase sees numerous simple burials without coffins, the middle phase sees many multiple burials in pits, and the final phase sees use of wooden coffins arranged in carefully set out west-east rows.

By the early 18th century the burial ground was no doubt full. How and exactly when the New Churchyard was finally closed for burial is slightly unclear at current time but the latest dated burial (1714) is from the Jenkes family tomb excavated in the north west of the cemetery. This tomb is one of very few to retain

readable coffin plates found to date. Excavation data suggests that up to 20,000 individuals were buried in the churchyard from 1569 to 1714 (HARTLE 2012a;2012b).



Fig. 4 – Photographs from Crossrail Site Evaluation in 2011 (MOL site code XSM10) – Left: early phase grave cuts; Centre left: mass burial pit; Centre Right: wood coffin burials (Copyright: Crossrail Ltd); Right: Lead coffins in the Jenkes family tomb excavated in 1985 (MOL Site Code LSS85) (Courtesy of MOLA)

The burial ground is closed and rediscovered

Rocques map of 1738-47 shows the numerous small alley ways and courts that occupied the site of Liverpool and Broad Street stations 100 years before they were built. It is also one of the last maps we have that labels the site as a burial ground or cemetery but buildings are now shown on the northern and western sides of the plot. By the time of Horwoods 1799 map, the center of the burial ground site is being labeled as 'gardens' (Fig. 5). Strype (1720) reported that the Old Bethlem area was home to many traditional craftsmen, stables, coaching houses and inns but that the area was essentially ill inhabited and slum like in its poverty. Redevelopment was not long in coming and two George Dances, a father and son, who occupied the Clerk of the City works office from 1734 to 1815 left a strong impression on Finsbury and Moorfields, changing the character of the area through a 'Georgian housing boom' of well-built houses for the merchant and professional classes.

The younger Dance embarked on a large residential scheme based on the Queens Square in Bath and his new residential estate would embrace Finsbury Square and Finsbury Circus. The New squares and crescents were to be linked to Broad Street and Bishopsgate by new streets like Eldon Street and Liverpool Street. In 1829 Liverpool Street, (first shown by GREENWOOD 1829), was constructed across the southern part of the former burial ground to improve access between Bishopsgate and the newly constructed gentlemen's houses at Finsbury Circus.

With this change in urban character came new residents and that is how Charles Roach Smith (1807–1890) came to be living in No. 5 Liverpool Street from 1840 to 1855. Roach Smith was a pioneer of 'urban site observation' and his *Illustrations of Roman London* (1859) remained the principal work on the subject until 1909. He wrote the book for the most part as a result of his personal investigations while he lived at No. 5 Liverpool Street, where he also displayed his ground breaking collection of antiquities salvaged during his extensive archaeology watching briefs around the city. This collection, of more than 1,000 objects, was eventually transferred to the museum of London when it was established in 1976.

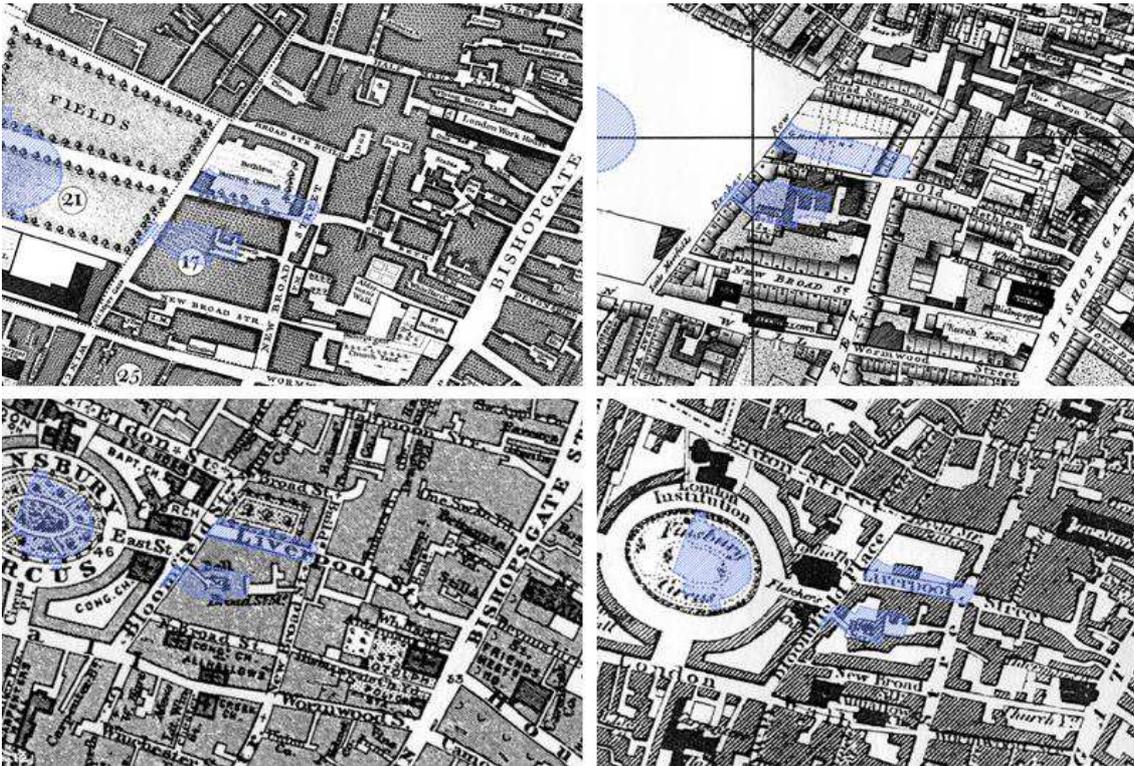


Fig. 5 – Historic map extracts. Clockwise from top left: Rocque 1746; Horwood 1799; Greenwood 1824; Stanford 1862 (Copyright: None)

Roach Smith endured constant battles with the London Corporation and was even brought before the courts for ‘receiving stolen property’ after his repeated efforts to protect antiquities from being looted from building sites and sold. He truly was an exceptional archaeologist and our work in London today, finally accepted and supported by the authorities, owes him a huge debt of gratitude.

Writing in 1882 Daniel Hack Tuke (1882) quotes Roach Smith, and recounts for us perhaps the first ‘archaeological observation’ of the, by then, long lost burial ground.

“Opposite my house on the other side of the street was a long dead wall, which separated the street from a long piece of garden ground. When my man buried in it a deceased favourite cat, he said he came upon the remains of human skeletons. But revolution brought about the disturbance of the cat which had disturbed some of Old London’s people. A few years later the cat’s coffin and epitaph were bought before the directors of the North London and Great Eastern Railway as a very puzzling discovery!”

(HACK TUKE 1882)

This all took place in the years leading up to the construction of Broad Street Station (Fig. 6). We can certainly imagine the scene from reference to Stanfords 1862 map, where the garden ground referred to is clearly opposite what would have been No. 5 Liverpool Street. The 18th and 19th century encroachment on the burial ground and construction of cellars in the new houses of Liverpool St will certainly have had an

impact on the buried human remains but, aside from Roach Smiths' observations, we don't have any direct references to the discovery of human remains until the construction of Broad Street Station in the 1860s.



Fig. 6 –Broad Street Station in 1906 looking west. Buildings facing north on Liverpool Street are on the left. Thousands of burials remain hidden below the street (Copyright: None)

The construction of Broad Street station in the 1860s with its vast underground storage yards, platforms and ticket hall removed a large part of the northern and eastern side of the cemetery. During the Broad Street Station works we are told that 'several hundred skeletons were removed' and '72 boxes taken away for re-burial at the City of London Cemetery' in Manor Park (HUNTING 1991). Then in the 1980s Broad Street Station was closed by British Rail and the land sold for construction of the Broadgate Centre business district. In response to that development the Museum of London archaeology team undertook an excavation in conjunction with the demolition of Broad Street station on a small area of the cemetery that was thought to have survived the construction of the station (MOL Site code LSS85; Dyson et al 1987; White 2009).

Around 400 skeletons were carefully excavated and retained for scientific analysis (Fig. 7). Additionally a large amount of disarticulated reburied human bone was discovered during a watching brief as the station foundations were broken out. This indicates that although there are references to exhumation works taking place in the 1860s, as above, this certainly does not appear to have been a thorough operation.

Interestingly, at the end of the MOL excavation all the recovered human remains, except those that were kept for analysis, were reburied 'in-situ'. This was an interesting decision and one which we have had to return to, as during our enabling works for Crossrail we have had to reinvestigate the area of reburial to address the main sewer pipe to 100 Liverpool Street that runs directly underneath the reburial pit. Several



Fig. 7 – Excavation of part of the Bedlam Burial Ground, Liverpool Street, by Museum of London Department of Urban Archaeology (MOL site code LSS85) 1985-6 (Courtesy of MOLA)

different approaches in terms of the treatment of the human remains have taken place so far during the previous works in 1863 and 1984-5. Exhumation and reburial in a cemetery is alleged in 1863 with residual material returned without ceremony to foundation fill material. In the 1980s skeletons were archaeologically excavated and a large sample retained for future analysis by the Museum of London (where they are still curated) and residual disarticulated material reburied without ceremony in a planned deposit within the foundations of the new building.

The historical impacts on the burial ground are illustrated in Figure 8. Approximately 30% of the cemetery remains for further investigation at part of the Crossrail project mitigation works. Archaeological recording has largely been absent during events to date and the surviving resource has the potential to add significantly to our understanding of the cemetery population and the phasing and organisation of the burial ground.

Research agenda

The historical background, and more recent history of observations, events and construction works, provides us with a genuinely vivid picture of the surviving cemetery, its development, and the context in which it was used. Investigation and research of the resource should give us insight into a crucial 145 year period of early modern London, which saw a population explosion, plague and epidemic, the Reformation, Civil Wars, the Restoration, the Great Fire of London, and the rebuilding of the city in brick and stone, the beginnings of the industrial revolution and ambitions for global trade. The research agenda looks at several high level aspects:

- Historical Development of the graveyard and context. Can formal organisation of the yard, its structures use of tombs, vaults, coffin burial, shroud burial, and mass burial be mapped and analysed alongside historical events and trends?
- Who was buried there and can any individual interments be identified?



Fig. 8 – Phase diagramme showing the successive construction impacts on the Bedlam Burial Ground between 1746 and 2013. The area of the Crossrail excavation is in yellow (Copyright: Crossrail Ltd)

- Where did the cemetery population come from? Can study of the population describe any local demographic trends – can immigrant individuals or groups be identified? – can different social groups and different beliefs be identified?
- What can the study of the cemetery population tell us about life and death in 16th and 17th century London? Health and wellbeing --diet – effect of poverty- prevalence of disease conditions – treatment of epidemic victims – burial practices –effect of different social position on health and well being.
- What does the cemetery and its history of redevelopment, after it closed, tell us about attitudes to exhumation and interment in the 19th and 20th centuries?

Field investigation results

A programme of field evaluation with trial trenches was undertaken as part of the Crossrail project in 2011 (HARTLE 2012b). This confirmed that several thousand burials could be expected within the footprint of the Crossrail ticket hall construction area and several characteristics of the surviving resource were identified, that:

- There is a phase of early inhumations that are fully articulated in grave cuts –buried in shrouds rather than coffins
- There is a phase of mass burial in pits

- There is a later phase of burial in individual wooden coffin burial but that the preservation of coffins and coffin furniture and burial markers is poor
- There is thick upper layer in the cemetery of disturbed and disarticulated human remains for which the research potential is limited to counting minimum number of individuals (MNI) and any significant unusual pathology or injury
- Structures within the cemetery, boundary wall, internal vaults or tombs may be encountered rarely since the sample area may not include the boundaries and no tombs have been seen in the evaluation phase
- Human bone and teeth are generally in good condition and capable of further significant comparative scientific analysis

Exhumation vs. archaeology investigation

So a key question facing the Crossrail project was how to approach the further investigation of the several thousand burials? Precedents exist suggesting that careful planning and full integration of the archaeological research design and construction programme would be essential to ensure that the objectives of all parties could be met (EMERY 2006). The objective as we see it is to arrive at a balance between formal scientific archaeological recording and mass exhumation by a specialist contractor. Mass exhumations have been a common solution to redevelopment of former burial grounds for centuries of course. The need to clear older burials to create space for new ones resulted in the digging of charnel pits and creation of specific vaults or catacombs where human remains could be collected together (HARDING 2002).

Clearly the site has archaeological and historical significance, but it is unlikely we would have to excavate every grave to do justice to the sites research potential. Following discussions with our specialist osteological team we agreed that it would be appropriate to select sample areas for investigation to full archaeological standards and that remaining areas would be cleared by an exhumation contractor. The differences in methodology between the two proposed contract types are set out in Figure 9. The exhumation work will be monitored under an archaeological watching brief to ensure that any structures relating to the cemetery, or particularly well preserved coffins or artefacts are recovered and recorded.

The evaluation data shows that no burials are able to be identified with individual burial records. There is likely to be little opportunity to analyse biographical details and compare to skeletal records, unless further named burials are discovered or specific identifying features. Additionally, the evaluation data did not identify any clear boundaries within the burial ground for differential use of the area (i.e. poor – wealthier –gender – age, for example) and in terms of chronological phasing the three phases appear so far to be largely homogenous. However, in the 1980s excavation area (to the north of the current investigation area) one vaulted tomb was identified. Sample areas are therefore proposed to be spread across the surviving cemetery area in anticipation of obtaining good data for spatial analysis comparisons.

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| <ul style="list-style-type: none"> ▶ Archaeology Contractor ◆ All work covered from public gaze ◆ Bulk excavation of disarticulated remains ◆ Hand excavation and detailed recording of articulated skeletal remains ◆ Drawn, photographed in situ ◆ Skeletons lifted individually in bags ◆ Full post- excavation scientific analysis ◆ Rebury remains | <ul style="list-style-type: none"> ▶ Exhumation Contractor ◆ All work covered from public gaze ◆ Bulk excavation of disarticulated remains ◆ Bulk excavation (by hand or with mini-excavator) and hand sorting of large skeletal remains ◆ Photographic record of any readable coffin furniture ◆ MNI record kept (skulls) ◆ Soils screened to extract smaller skeletal remains ◆ Bag remains and rebury |
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Fig. 9 – Best practice in mass exhumation vs. archaeological investigation (Copyright: Crossrail Ltd)

Site	Dates	Estimated total population	No. Graves excavated	Sample size
St. John’s School, Peel Grove, Bethnal Green, London (AOC Archaeology 2013)	1840 and 1855	20,000 over 7.5 acres	1060	5.3%
New Bunhill Fields burial ground, Southwark, London (MILES AND CONNELL 2012)	1821-1853	33000	783	2.37%
St Marylebone Church, London (MILES et al 2008)	1400-1850	?	349 (excl vaults and Church)	20% (of area)
St James’ Clerkenwell, London (AOC Archaeology 2013)	c.1660-1853	c.3000	700	23%
City Bunhill Burial Ground (MOL 2013)	1833 - 1853	18,000	239	?
Chelsea Old Church (MOL 2013)	18-19th century	?	290	?
St Pancras Old Church (MOL 2013)	1793 - 1854	?	699	?

Tab. 1 – Archaeology sample data from other post medieval/early modern burial grounds excavated in London

What should the sample size be? A brief review of recent previous excavations of post-medieval/early modern cemeteries in London (Tab. 1) indicates that previous samples have ranged from c.2.4% to 23%. Of course there are many variables to consider and each case is a product of circumstances of the project and funding, research potential, condition of burial ground and skeletal material.

The actual selection of sample areas for full excavation is being developed in liaison with construction engineering teams. The burials layer is up to 3m deep from the surface of the street and the site is very constrained in terms of space. Therefore it is essential that excavation be fully integrated with the construction process and that areas are selected not only for an optimum archaeological sample but also that are logistically achievable, within a fixed timeframe and in safe way. Several issues stand out to suggest that in the case of the New Cemetery we should be considering a sample size on the upper end of the identified range, not least the research interest in the periods represented and lack of biographical supporting detail (i.e. lack of formal burial registers). Additionally, the history of impact on the site (previous damage) and opportunity to synthesise archaeological data obtained 30 years apart, are also factors that will influence selection of a higher than average sample size.

Construction planning

We now wish to look at some of the construction planning issues that affect the final project design for the excavation. Addressing the impact of piling is often difficult for archaeologists. As with other ground improvement processes there is little opportunity to record the archaeology during the actual process other than collecting and processing the arisings from the auger drill. The archaeology surviving within a pile line is often 'sacrificed'. Excavating areas of deep urban stratigraphy in advance of piling introduces logistical difficulties and greatly increased costs. Detailed archaeology recording carried out within the safe and supported area provided by the new piles or diaphragm walls is both cost effective and in terms of methodology, safer and logistically much more straightforward. However when dealing with human remains is this standard approach acceptable? Can the human remains be exhumed using modern construction equipment?

Construction of the Liverpool Street eastern ticket hall requires piling activity to construct the 30m deep walls of the new ticket hall prior to excavating the interior and building the several floors of the underground station. Several walls of piles of diameter 600mm to 1200mm in diameter are to be drilled on the northern, western and southern sides of the ticket hall area (see Fig. 10).

The pile type methodology is cased Continuous Flight Auger (CFA) which requires excavation and casting of guide walls either side of the pile line, and then the soils are drilled out and the voids replaced simultaneously with steel reinforcement cages and concrete (Fig. 11).

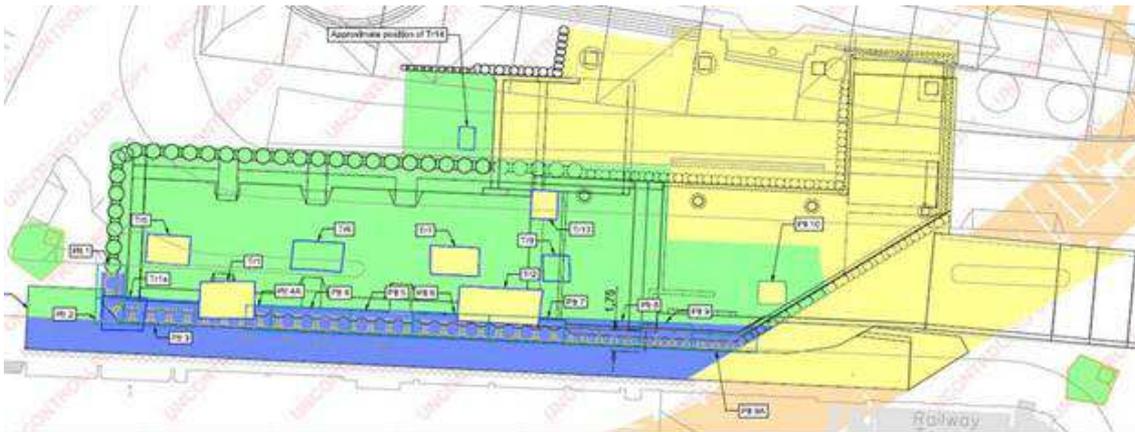


Fig. 10 – The blue area is the excavation required for the utility corridor (Phase 1); Green areas are those within Phase 2 including piling and excavation of the main structure; Yellow areas are where previous construction has removed any archaeology or where evaluation trial pits have removed and recorded all archaeology. The location of piles are the closely interlocking lines of circles of various diameter size (Copyright: Crossrail Ltd)

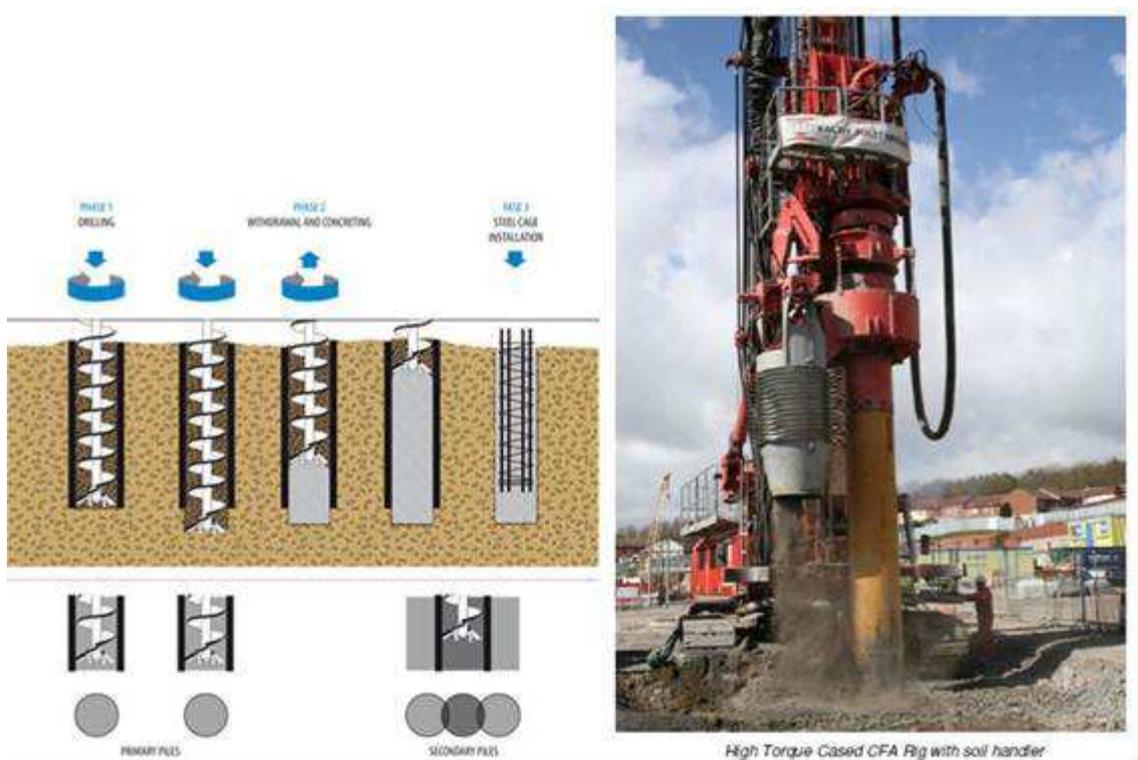


Fig. 11 – Left: cased CFA pile methodology (courtesy of Trevi Group); Right: cased CFA pile rig with soil handler attachment (courtesy Bachy Soletanche Limited)

As the section profile drawing (Fig. 12) demonstrates, the piling activity would of course disturb human remains contained in the 2m thick cemetery soil layer and drill through the underlying medieval and Roman period deposits. What mitigation measures should be taken to address this?

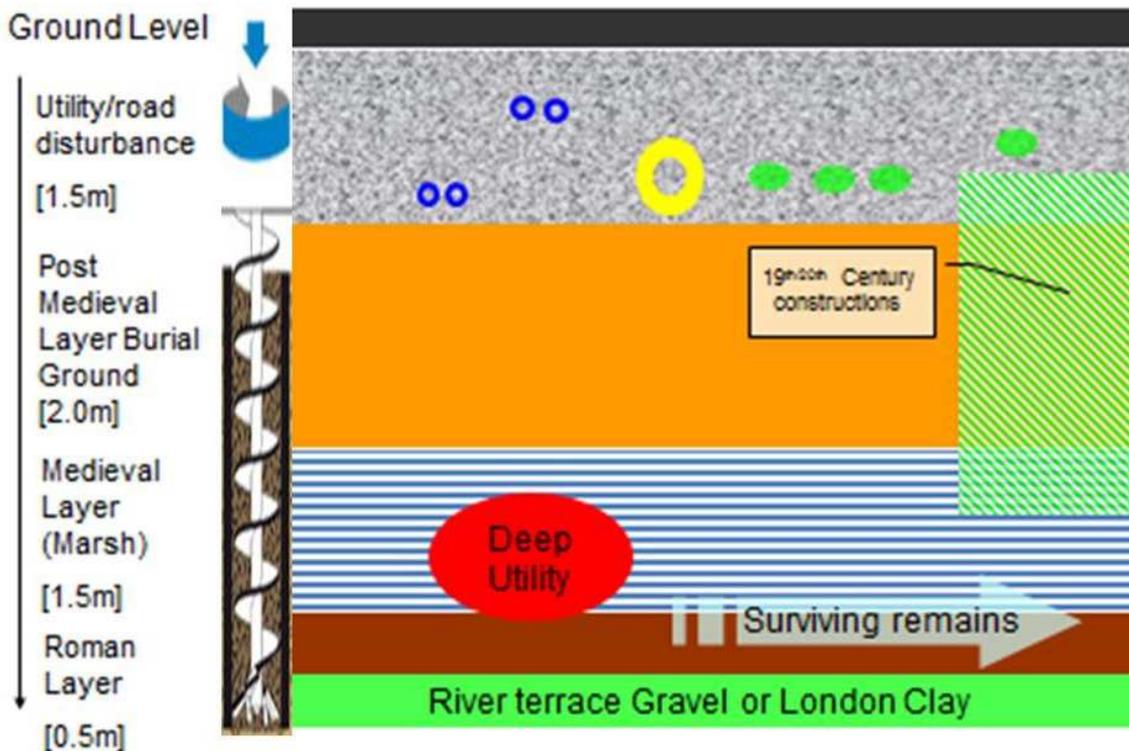


Fig. 12 –The Liverpool Street site deposit model (schematic) (Copyright: Crossrail Ltd)

Prior to any construction work in the UK that will take place in a former burial ground (either a historic ground now not recognised as a burial ground or a disused ground) the developer is required to apply for an exhumation license from the UK Ministry of Justice. The process is governed by the Burial Act of 1857 (UK Legislation 1857), and (according to the site context) certain other more recent legislation. The application should set out the proposed method of exhumation, proposals for archaeological study (if anticipated) and long term storage or reburial and how care and decency is to be achieved in the exhumation process. The exhumation process should be covered from public view, should allow disturbed remains to be collected and bagged by a competent and experienced exhumation contractor. Reburial of the remains, particularly of post medieval and early modern date is usually a condition of the license. This should take place at a licensed burial ground that has been agreed with the local authority environmental health officer and stated in the license application.

English Heritage, in its role as the UK Government's lead advisory body for the historic environment, has a statutory role in the planning system. Central to its role is the advice they give to local planning authorities and government. They also publish guidance on the management of the historic environment. In 2001, English Heritage and the Church of England set up a 'Human Remains Working Group' to look at the 'complex and emotive' issue of dealing with the treatment of human remains during development activity and in archaeological research. Indeed, the complex nature of the issue is amply demonstrated by the fact the published guidance arising from this exercise (MAYS 2005) runs to 54 pages of factual background, best practice advice and references.

The methodology that is adopted for clearance by the exhumation contractor contrasts with that used by the archaeologist, but in terms of the exhumation license, needs to meet the minimum standards for exhumation and certain conditions that are attached to the license. The key condition that does affect precisely how the exhumation work is achieved is that: “any removal or disturbance of the remains shall be effected with due care and attention to decency”. The parallel phrase used by English Heritage in their guidance (MAYS 2005) is that human remains should always be “treated with dignity and respect”.

In relation to the mass exhumation of the remaining part of the Bethlem Burial ground, there are different factors and viewpoints that need balancing whilst achieving the work with dignity and respect. Archaeologists need to maximize the research value of the investigation. The construction manager needs to ensure the health and safety of the workers involved and that the work can be integrated successfully with the project programme and cost estimates. The client organisation needs to protect its reputation and the interests of the public.

Construction method

In order to prepare the ground for the first pile line to be inserted, exhumation of human remains was undertaken in a series of open trench excavations by an exhumation contractor; largely by hand dig, with an archaeologist attending to observe. Each site was covered with a temporary tent to control the public gaze from surrounding office blocks. Soils were moved with a small excavator where possible, but, due to the density of service utilities that were still in place, much of the material was hand excavated into skips which were lifted out of the trenches by crane into waiting trucks (Fig. 13). The soils were then driven by road to the contractors' facility to be processed. There, the soils were passed through screens to separate the human skeletal material from the soil. At this point it was bagged and a note made of the MNI data. The bags are then retained in the secure facility until they are reburied in a new mass grave.

Due care and attention to decency were achieved through use of experienced contractors with a relevant track record and training in this type of work. However, damage to the remains did occur. The need to insert steel interlocking sheet piles to create the open trenches did result in some unavoidable damage and fragmentation of the skeletal material. A review of the process upon completion found that due to the need for significant amount of hand excavation, the method included numerous health and safety risks, was very time consuming, and introduced significantly increased costs when compared to bulk excavation.

This raised significant concerns with the construction management team. The confined space nature of the excavations and presence of utilities added to health and safety hazards which were in fact avoidable. Two incidents of lifting equipment failure were recorded. Operatives had to work alongside live electric, gas, water and communications pipes and cables and this always added the danger that unintended strikes with tools or plant could lead to injury, flooding or power failures etc. The cost and programme issues were exacerbated by the presence of nearby buildings with weak foundations. This meant that rather than opening up a single

long trench, smaller sections had to be completed and backfilled separately to control risk of settlement damage to those buildings.



Fig. 13 – Liverpool Street exhumation in progress for south pile line (Copyright: Crossrail Ltd)

Post construction review

Two alternative methodologies were put forward by the construction manager to address the issues raised by the first pile line. It was proposed that new technology in piling rigs (specifically enclosed soil handler attachments that could remove piling spoil direct to a skip or truck) or vacuum excavation could achieve the same outcome as the open excavation, but with a much improved safety, programme, and cost profile. Once all the piles were in place the programme and cost advantages achieved with an alternative method would, it was argued, have a positive impact on the further exhumation of the burial ground and archaeological investigations, potentially allowing additional time for the main phase of mitigation.

Could the piles be inserted by the continuous flight auger (CFA) method without the need for a prior clearance of the burial ground soils by hand? A soil handler was proposed that would collect the soil arisings containing human bone into a container (see Fig. 11), for later separation from the soil and reburial of the remains off site. It was suggested that this method would cover the exhumation from public view, avoid the hazards associated with having people working in confined spaces below ground, and achieve the same outcome, i.e that the human remains would be safely extracted from the site and reburied.

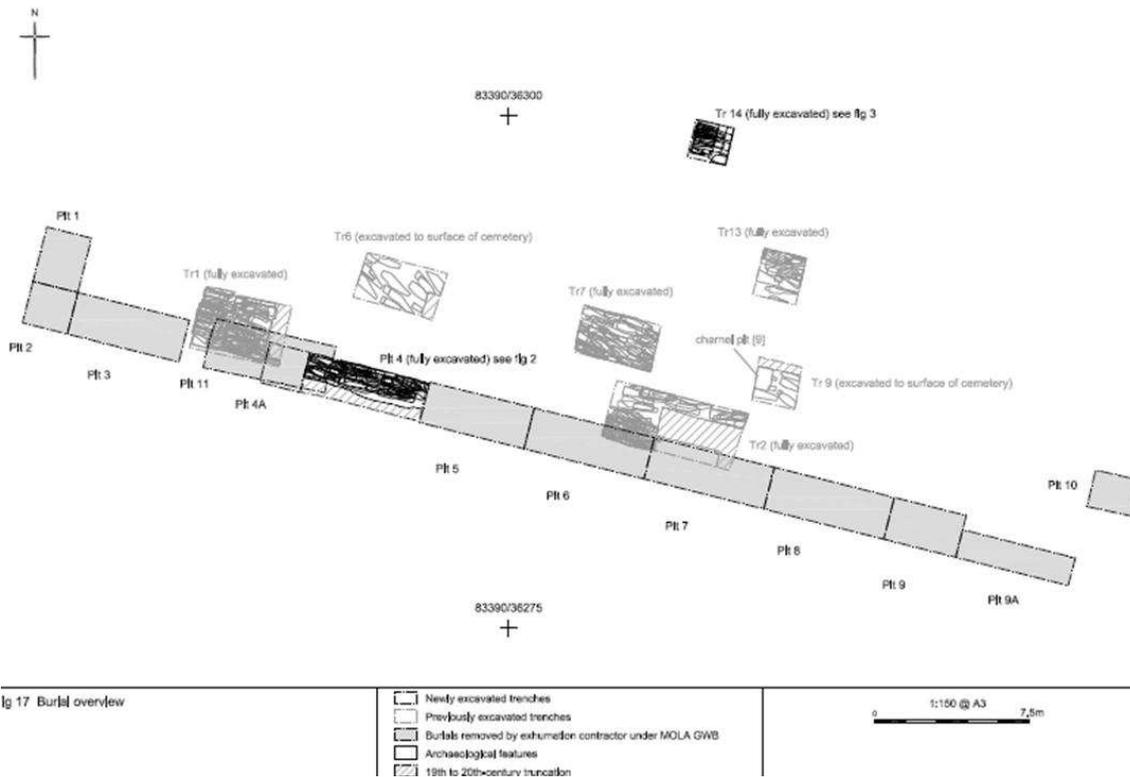


Fig. 14 – Liverpool Street the series of individual pits needed to exhume human remains from the south pile line Pit 1 –Pit 11 (Copyright: Crossrail Ltd)

If the CFA method was unacceptable, a second new technology was suggested by the construction team. Again, to avoid the need to engage people working in confined spaces, it was suggested that vacuum excavation could be carried out from the surface of an open trench. This technology is now routinely used in locations where the presence of live utilities makes excavation dangerous. It uses high powered suction and compressed air or pressurised water jet to loosen the soil matrix and vacuum the soil arisings into an on board container. As with the previous example the soils would be taken away by the exhumation contractor for processing.



Fig. 15 – Left: vacuum excavator at Liverpool Street (Copyright Crossrail Ltd); Right: diagram of vacuum excavation equipment (Courtesy of SUC-EXC UK LTD)

We presented the alternatives to the UK Ministry of Justice in a revised application for a burial exhumation license under the 1857 act of parliament. However, both these methods in practice presented objections.

Although both alternative methods would achieve the same outcome as a trench excavation, the increased fragmentation of the skeletal remain was stated as a reason to fail the test of 'due care and attention to decency'. From an archaeological perspective, certainly the CFA method did not allow an appropriate response to the discovery of unforeseen contexts, such as preservation of coffins or intact burial vaults and it was untested whether or not the vacuum excavation method would in fact be successful. There was also potential for a negative impact on the reputation of the client organisation should the works have adopted either alternative method. However there are clearly ethical issues present that deserve review. Injury, disablement and death in the construction workforce are unacceptable outcomes in the modern workplace (see <http://www.crossrail.co.uk/sustainability/health-and-safety/target-zero>). Should 'due care and attention to decency' to the skeletal remains of those long departed take precedence over the health and safety of workers involved in their excavation? Does the increased fragmentation of human remains during exhumation represent an unacceptable departure from a dignified and respectful process?

Interestingly, interventions and reactions to the burial ground over the previous two centuries provide a candid picture of how the construction industry and archaeologists have addressed these issues and in one case have provided the very conditions for increased fragmentation that we are trying in the 21st century to so carefully avoid.

We are told (HUNTING 1991) that several hundred skeletons were carefully removed in 72 boxes during the construction of the Broad Street Station in the 1860s. These were allegedly reburied in the City of London Cemetery, but, that institution does not hold any record of the event. Then during archaeological excavations in 1985, archaeologists discovered that much soil containing human bone was reburied within the backfill of the station basements in the 1860s. So the treatment of human remains at that time appears to include an attempt at exhuming some of the skeletons but is not concerned with collection of disarticulated parts.

In 1985, the Museum of London Archaeology Service took a different approach to management of the human remains. They report that several hundred intact skeletons and disarticulated human remains found in the secondary context from the 1860s construction work, were reburied on site and a sample of around 400 individual skeletons was retained for full analysis (WHITE 2009). The skeletons retained for bio-archaeological analysis were retained by the museum and not reburied. According to the projects' archive report; 'all the human remains recovered during the excavations were removed in accordance with the rules laid out in the Home Office license' (DYSON et al 1987). This appears to relate to those skeletons excavated archaeologically. Several hundred 'other' skeletons and residual disarticulated remains were reburied 'in-situ' within the foundations of the new 1985 building. Although the site had long since ceased to be recognisable as a burial ground, 'several skips-worth of soil containing human remains, including a few lead coffins, were mixed with a lean mix concrete and reburied in the old excavation hole' (HARTLE 2012).

In 2012, the Crossrail archaeology investigations rediscovered the human remains that were reinterred in 1985. The decision at that time to mix the remains with concrete has necessitated that the deposit be broken

out with pneumatic hammers. Figure 16 shows the unavoidable fragmentation of the human remains as they are carefully removed from the site for reburial.

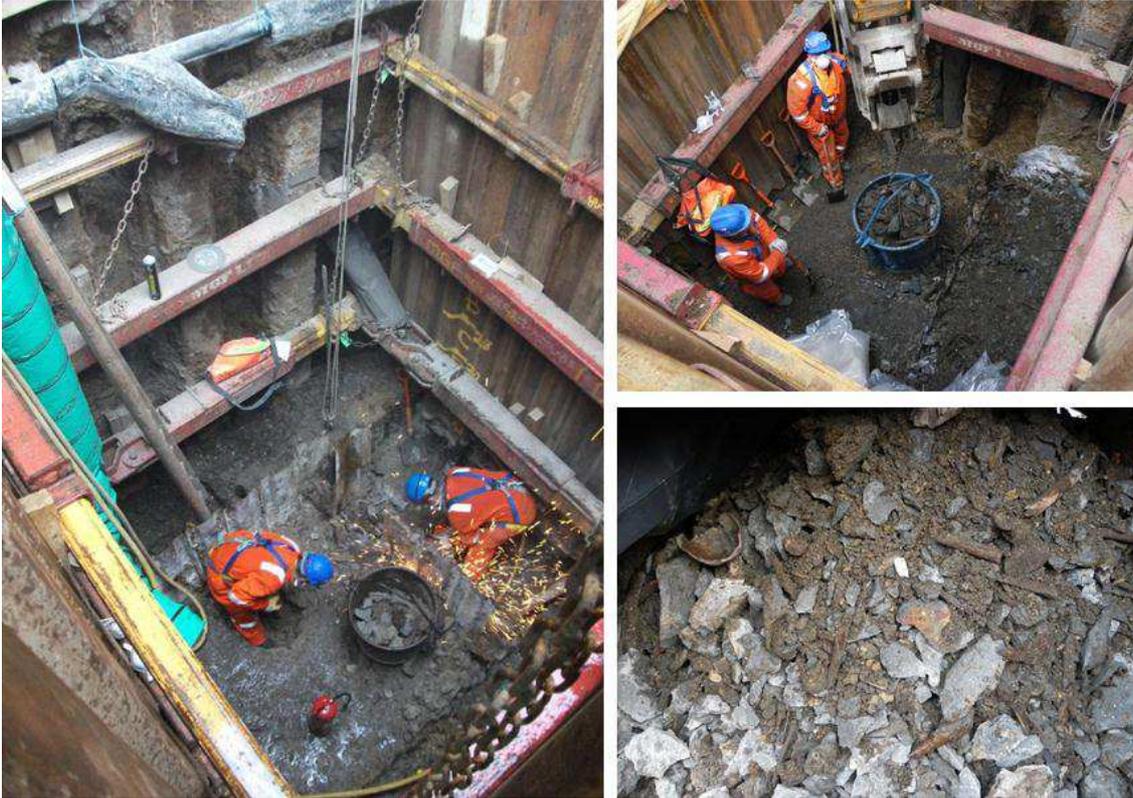


Fig. 16 – Excavation of 1985 reburial site. Below right: Fragmentation of remains that were reburied mixed with concrete (Copyright: Crossrail)

Conclusion

The application to the UK Ministry of Justice to consider use of new technologies to remove human remains in the pile line or other areas of the site has not been approved. However, recognising that the mass exhumation of post medieval burial grounds can include a degree of mechanisation, hydraulic excavators shall be used to remove remains in areas that are not be subject to detailed archaeological investigation.

In terms of the reburial, the conditions attached to the current exhumation license are very clear. All human remains shall be reburied in an appropriate burial ground. Large and smaller fragments present in the cemetery soils shall be screened and as far as practicable all skeletal fragments shall be collected. Around 600 skeletons will be retained for scientific analysis at the Museum of London labs and the results published. Following that, these remains will also be reburied together with the other material.

There is an opportunity during the Crossrail project to synthesise the long history of investigation of the Bethlem burial ground. Documentary work shall be combined with the burial ground data: on the structure and phasing of the site and study of the human remains themselves, into a final report. It will also be considered whether the human remains from all phases of investigation can be consolidated into a single

place of burial? If the 1860s skeletons can be relocated, there is an opportunity to ensure that those skeletons together with those retained in 1985 and the human remains from our Crossrail investigations are placed back in the ground in the same plot and a suitable monument constructed to commemorate all those buried in the New Churchyard.

The case study shows that as a modern society we require through law that the remains of the dead are treated with dignity and respect. When they reach a certain age and contain potentially significant historic data we are content that retaining them in a laboratory for analysis is consistent with that dignity and respect. We have also seen inconsistent approach to reburial of human remains in the past. It seems appropriate that where the site in question is no longer a recognisable burial ground, reburial should take place within a modern burial ground.

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