

advice series

paving

THE CONSERVATION OF HISTORIC GROUND SURFACES

paving

THE CONSERVATION OF HISTORIC GROUND SURFACES



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Introduction

The ground surface is a part of the historic environment which can be often overlooked. However, it is the treatment of the ground plane that holds a historic space together and, where surfacing materials survive, there is a far richer, more complete picture of the form of a place and a better and more authentic connection with its past.

Historic paving comes in a wide variety of forms ranging from rounded cobbles used in vernacular farmyards, gardens or in early streets; to setts, cut blocks of hard stone used in roadways; flagstones of limestone, slate or granite used on urban footpaths, stone steps or kerbstones; and less commonly brick, fireclay or wood-block pavers.

The survival of paving from an earlier age provides a sense of historical continuity and gives a connection and greater insight into the past history of a place, whether a town, city or rural farmyard. Such a tangible connection to earlier times helps us to better understand and interpret our history.

Historic paving can be as significant in shaping the architectural and spatial character of a street or square as the structures which enclose it. Old paving complements and underscores the architectural quality of important or historic buildings, and aged or worn ground surfaces lend historical context, depth and visual richness to their setting, helping us to better appreciate and understand their value.

In urban areas, historic ground surfaces have the power to shape the character of a town or city. Paving designs, local styles and materials are intrinsic elements of the urban landscape and help form the identity of individual streets. Well maintained and properly conserved street surfaces do not merely add to the visual beauty of a town, but are an expression of a thoughtful society that cares about its heritage. They can foster civic pride amongst residents and attract admiration from visitors. Historic paving can be of particular importance in areas with reduced traffic, where they can be better seen and appreciated and, if in the roadway, they can also contribute to traffic calming. Loss of paving depreciates this character, whether it is caused by systematic removal or by gradual erosion which occurs if protection is not actively promoted.

Whether urban or rural, part of a building complex or transport infrastructure, historic paved surfaces are a testament to the lost skills of the mason, cobble-layer and sett-layer. The skill and precision with which paving units were formed and laid add an irreplaceable dimension to their visual richness. Modern paving, even where it is of high quality, rarely achieves the hand-crafted distinctiveness of well-worn traditional surfaces.

Traditional materials add enormously to the texture of a historic setting, but as they form the ground surface upon which we walk and travel, they are exposed to wear and tear to a far higher degree than buildings. In public areas, functional demands such as the need to provide an even and safe walking surface, traffic markings, load-bearing capacity, or excavation to lay underground cables, mains water supply and drains have led to the loss of most historic paving. This has made what survives all the more precious.

The purpose of this guide is to advise the custodians of historic paving, whether private owners, institutions or local authorities, on how to conserve and care for such surfaces.

Street furniture such as milestones, horse troughs, bollards and other stone elements, as well as iron or timber features such as benches, lamp standards and gratings, are closely associated with the ground surface, and therefore advice on their conservation is also included.



1. A Short History of Paving in Ireland

Early paving

Archaeological evidence for the earliest manmade ground surfaces in Ireland indicate that these were probably of brushwood or timber wattle which was used to lay trackways and causeways or to make streets passable.

In medieval Ireland, the use of stone to pave streets and trackways became more common. Sections of cobbled paving have been found in archaeological excavations in Dublin, while flagged causeways or toghers survive in rural locations. A section of medieval cobbled pavement, uncovered in archaeological excavations at the medieval St Audoen's Church in High Street, Dublin can be viewed within the Office of Public Work's Visitor Centre now located in the former Guild Chapel of St Anne.



A togher at Leamonaghan, County Offaly links the Early Christian period Saint Managhan's church to Saint Mella's cell. The togher is approximately 370m long and 4m wide and paved with a mixture of sandstone flags and limestone outcropping

Early cobbles survive in Front Square, Trinity College Dublin, including rounded limestone clasts interspersed with white quartz, granite and other igneous rocks including andesite and diorite. Unlike setts, cobbles are not dressed but are rounded as found. Randomly laid cobbles can be seen on footpaths and carriageways in early photographs of the main urban centres in Ireland. Many examples survive today in farmyards.



Cobblestone paving in Trinity College, Dublin. Although this paving has been re-laid several times, many of the cobblestones may date from the original mid-eighteenth century creation of Front, or Parliament, Square

Paving advances in the eighteenth century

The majority of historic paving found in Ireland today dates from the eighteenth century onwards. Dublin was the focus of attention for the paving of its main streets and thoroughfares and the bulk of the relevant historical records relate to the capital city.

The earliest Act (4 Geo. I. c. 11) entitled *'For the better amendment of the pavement, and more effectually cleansing of the streets of the city of Dublin, and removing encroachments and nuisances that are or shall be erected therein, etc.'* was passed in 1717 as *'the public pavements in the City and suburbs, and the adjoining liberties, were, in many places, very much out of repair and in several places raised to such a height that carriages or horses could not with safety pass over.'* Under the Act, the Lord Mayor, with one of the Sheriffs and two of

the Aldermen, were authorised *'to direct the levelling, new paving, raising and mending of the pavements'* and empowered to charge the chief tenants inhabiting houses and owners of waste ground with the price of carrying out this work before their houses and grounds, but not to exceed 20/- at any one time.

A further Act of 1719 (6 Geo. I. c. 15) stated that the Lord Mayor and one Sheriff within the City and every Alderman within his respective watch were appointed *'to regulate the pavements.'* The Grand Juries were empowered to ascertain the cost and the sums of money that the inhabitants should pay, such sums to be apportioned and levied.

Further legislation in 1729 (3 Geo. II. c. 13) charged the Church Wardens and the Directors of the Watch *'to examine and return all defects in the paving and cleansing, and the Lord Mayor was required to execute the trust imposed on him according to such returns.'*



A Prospect of the Parliament House, in College Green Dublin by Joseph Tudor, 1753. In Ireland and Britain, as in continental Europe, the construction of footpaths separated from the general carriageway did not begin to emerge as the norm in city streets until the eighteenth century. This view of College Green shows the street paved as a continuous surface with no footpaths, and with bollards enclosing areas in front of Trinity College and the Parliament House. Tudor's view of Sackville Street and Gardiner Mall in the same decade shows footpaths in this new development, but not on the existing side streets: Henry Street and Earl Street



Forty years later, **The Royal Exchange, Dublin**, by James Malton c. 1792, shows footpaths outside, not only the public building, but along either side of Dame Street also. This transformation was the work of the Commissioners for Paving the Streets of Dublin, commonly known as the Dublin Paving Board

The Dublin Paving Board 1774 – 1849

The Board of Commissioners for Paving the Streets of Dublin, or the Dublin Paving Board, was set up by an Act of Parliament in 1774: *For paving the streets, lanes, quays, bridges, squares, courts and alleys within the city and county of the city of Dublin, etc.* (13 & 14 Geo. III c. 22). The Board met frequently, at least weekly in the early years. Manuscript volumes of the minutes of these meetings are kept in the Dublin City Library and Archive in Pearse Street. This huge volume of records holds the history of paving in Dublin from 1774 to 1849.

Five city divisions were created, each composed of two to five parishes, with committees elected from within the parish vestries. The parish vestries were an important agent of local government, and their powers to collect Watch Tax and Minister's Money were extended to include a new Pavement Tax, which was not to exceed a shilling in the pound of the yearly rent as rated for the Watch Tax. The Committees of the Divisions entered into contract with the various paviours, stone-cutters, masons and gravel suppliers for work within their groups of parishes, while the specifications were provided by Mr Thomas Owen, Surveyor to the Board. The monies collected were administered by the Treasurer and payments handled by the Board in most cases.

Each committee reported on the state of the pavements in its division and proposed the streets most in need of paving. The remit of the Paving Board ran further than simply paving the city streets. An early meeting in 1774 resolved, that *'all signs, sign irons, posts whether of wood or stone, spurr stones, landing stones, boards, bulks, show-glasses, show-boards, sett-out windows, and pent-houses, in this city and other places mentioned in the Act for the Paving the Streets etc. shall be immediately removed.'* In addition *'all steps, and doors, opening or leading from the foot ways or carriageways into vaults, cellars or other places be immediately removed, filled up, or altered.'* Another meeting of 1774 resolved that no windows should project over the flagged path more than three inches at the sill or six inches at the head. So-called 'nuisances' were proposed for removal, including a number of medieval half-timbered cagework houses which projected out over streets.

The Dublin Paving Board minutes provide a detailed source of information on the paving materials used in the capital city in the eighteenth century. An early meeting of the Corporation for Paving specified the materials required as follows:

- *Flags of the best hard mountain stone, at least four inches thick at the edge, free from yellow soft grit (those at the top of the quarry by no means to be used) chizzel'd flat in the surface, & squared on the four edges, all other flags, at least two inches & one half thick on the edges, not chipped or spaul'd off as they are generally on the under edge, but squared and made very flat on top.*
- *Curb [kerb] of the best mountain stone, squared at the ends, the outer face, the surface and the inner edge, to be full nine inches deep on the outer face and edge, & one foot on the Top or Surface, free from Yellow Grit.*
- *Sound pebbles or paving stones free from Shakes or Splinters, which will bear hand trimming not less than four inches over each way.*
- *The best screen'd Gravel free from Loam.*
- *Bullock stones or any other hard Granite, of nine inches deep, dressed on the Top and Side, & made wedge-fashion, the bottom to be four-fifths of the top.*
- *That the grates be made of Iron Bars, not less than one inch square at the least, the bars to be no more than one inch asunder*

Resolved that it is the opinion of this Committee that the curb-stones of the foot-way be of mountain stone of twelve inches broad, nine inches deep, with a bed of not less than six inches, & four inches thick at the tail squared thro'.

A contract between the Third Division and four or five individuals is typical of many contracts recorded:

James Kelner, Paviour: ... *Paving Dame Street from Trinity Lane to Crampton Court, at two pence halfpenny per square yard, including the levelling of the same street, according to a section this day signed by me, & I do hereby contract to take up the old pavement, to remove the heights and fill in the hollows, according to the said section, to finish the same with a Crown Causeway, Chanel & Rising...*

Arthur Buckton, Stonecutter: ... *to furnish cut stone for flagging the same street, with the best hard mountain grit, the flaggs not to be less than four inches thick at the edge, & to furnish curbes of the same stone, twelve inches broad, nine inches deep, with a bed not less than six inches & to be four inches thick at the tail squared throughout; to bed the same in good mortar at nine pence per foot superficial. And I do hereby agree to work up square and bed, such of the old material as may be found sufficient in the said street at twopence ha'penny per foot superficial...*

Robert Mason, Gravel: ... *to supply the Paviours to be employed in Dame Street by the said Committee, with good bank gravel for the pavement of said street at thirteen pence per cart load; to be furnished in such proportions as the workmen shall demand...*

John Dempsey of Loughshinny: ... *for Pebbles [i.e. cobbles, paving stones] at three shillings per ton weight, or with James Casey at two shillings per load, as the said Committee shall on experiment find cheapest to bear...*¹

Another reference was to 'Crown pavement of Pebble, and of a Flag'd footpath', and 'be paved, flag'd & finished in the new method with Pebbles' indicating the carriageway was cobbled and the footpath flagged.²

In addition to 'the best hard mountain stone', the Board, following several representations from Richard Gibson and Nicholas Hart, also authorised the use of Arklow stone 'of quality allowed by Judges to be superior to the Scotch paving stones used in London.'³ 'The size of the stones which Gibson & Co. shall furnish for Paving the Crosses of the Street & Essex Bridge, shall be of eight inches in depth, the largest twelve inches in length, & six inches in breadth, the smallest six inches long, & four inches broad, the general run of stones will be nine inches long, and five inches in breadth, all accurately squared, & the same in quality of the sample now before you.'⁴ It is likely that the Arklow stone referred to was diorite.

Limestone kerbs were also used, a contract between Brian Gaffney, quarryman, and the Third Division Committee of 7th October 1774 included: 'to furnish limestone curbing stone, as many as they shall want, punched on the face & rough squared in the edges & ends, with a punch or hammer, the stones not less than nine inches thick at the thinnest place, and from two to five feet long, & twelve inches broad, no stones to be taken but what has their full corners: and also as many other stones as they want, of twelve inches over and nine inches thick squared & edged as above; all at the rate of seven pence per foot, superficial measure, face only to be measured & not edges...'

Another Third Division contract with Arthur Buckton, stonecutter, possibly suggests that Dublin calp was sometimes used for kerbing, 'for laying black stone curbings from twelve to sixteen inches broad.'

¹ Pearse Street Library: Dublin City Paving Board: Minute Books, vol. 1. PB/Mins/1.6 June 1774- 26 Jan 1776, pp42-4, 2nd August 1774.

² Pearse Street Library: Dublin City Paving Board: Minute Books, vol. 1. PB/Mins/1.6 June 1774- 26 Jan 1776, p19, 15th July 1774.

³ 'Square-paving, by some called Scotch-paving: by this was recently understood cubical stones, of blue whynny; they are, however, now nearly disused in London, owing to their inferiority of the next-mentioned: Scotch granite; a hard material, usually of a bluish or reddish colour, with which the London road-pavements are formed.' Definition from Luke Herbert, *The Engineer's and Mechanic's Encyclopaedia* (London, 1836)

⁴ Pearse Street Library: Dublin City Paving Board: Minute Books, vol. 2. PB/Mins/1.2 Feb 1776 – 20 December 1776, p196.

Nineteenth-century developments

As early as 1838, The Penny Cyclopaedia of the Society for the Diffusion of Useful Knowledge reported of Dublin that: *'The streets in general are Macadamized, the footpaths for the most part flagged, and the curb-stones and crossings of cut granite. The city has been well lighted since 1825 with gas.'*

In 1841, following the Municipal Corporation Reform (Ireland) Act, the old City Assembly of Dublin was replaced by a more representative City Council and, in 1849, the Council took over the duties of the Wide Street Commissioners and the Paving Board under the Dublin Improvement Act. The minutes and accompanying reports of the Municipal Council of the City of Dublin from 1849 to 1869 are kept in manuscript volumes in the Dublin City Library and Archive, Pearse Street, and the records from 1870 onwards in published volumes. The records include regular reports from the Paving and Lighting Committee.

The nineteenth century brought a range of changes and innovations that affected street surfaces within the city. In 1870, the Council was asked to consider a 'Proposal for a system of tramways for the City of Dublin and Suburbs.' Seven tramways were subsequently laid in the major thoroughfares of Dublin, and stone setts were the favoured form of street surface associated with them. The tram company appears to have paid the Council for repair to streets following track laying:

Committee received an application from the Dublin United Tramway Company, asking them to carry out the work of repaving Capel-street;... the Company paying the entire cost of the work, and that the Company would furnish all the new setts that may be required.⁵

It is not clear when setts began to be used, but the type which survives today in cities and towns across the country appears to date from the mid to late-nineteenth century.



Main Street, Blackrock, County Dublin with a setted street incorporating tram tracks (Lawrence Collection, image courtesy of the National Library of Ireland)

⁵ Report 1890, Vol. 1, pp251-4.

A noted source of diorite of a dark green hue was the quarry owned by Charles Stewart Parnell on his estate at Avondale, County Wicklow where he employed 200 sett dressers from 1884 until his death in 1891, after which the business went into decline. Setts from this quarry can still be seen in Foster Place, Dublin. Many setts are understood to have been of imported Welsh and Scottish stone⁶ although details of the stone type and provenance have not been established. It is possible that granite setts of reddish colour which can be seen in many places were such imports. Paving setts were also recorded being made from diorite at Arklow in 1911.⁷

Tar grouting of setts was already common practice in the late-nineteenth century as evident from the following reference from 1880:

... the attention of your Committee having been called to the injury done to the paving in Harcourt-street, which had been recently paved and tar grouted, by a gas opening not properly repaired...⁸

Asphalt as a surfacing material began to be introduced in the late-nineteenth century as a watertight and economical alternative for surfacing of footpaths. In 1880, the Council received a report on asphaltting footpaths:

... Council... have had under consideration a favourable report from the Deputy-Surveyor on the footpaths already laid with Mineral Rock Asphalte, and being desirous of laying other footways throughout the city, which are in urgent need of repair, with the same description of asphalte... It is proposed, in the first instance, to give the Mineral Rock Asphalte Company an order to lay 5,000 yards of their asphalte, and then, if the Deputy-Surveyor's Report on the manner in which that portion of the work has been executed is favourable, a further order to lay down another 5,000 yards will be given, and so on...⁹

... the following is a list of the footways which are to be laid with Mineral Rock asphalte, being the first 5,000 yards to be executed out of the contract with the Mineral Rock Asphalte Company, for laying 16,000 yards (see Report no. 220, of 1880):

South Side: Pleasant-street, Harcourt-terrace, Brunswick-place, South Circular-road, Bishop-street, Lennox-street, Townsend-street.

North Side: Temple-street, Portland-row, Guild-street, Sheriff-street, Store-street, Berkeley-road, Amiens-street.

Macadamising was also a widespread surfacing method, primarily for carriageways, but possibly also for footpaths. As distinct from later tar-bound macadam, the use of water-bound macadam was pioneered around 1820 by Scotsman John Loudon McAdam, as a simplification of earlier methods. McAdam found that rock foundations were not necessary, and asserted that native soil alone would support the road and traffic upon it, as long as it was covered by a road crust that would protect the soil underneath from water and wear. Consisting of two-inch broken stones in a single layer six to ten inches (150-250mm) deep and compacted either by the road traffic itself or by a cast-iron roller, this method required a great deal of manual labour, but resulted in a strong and free-draining pavement, and remained the widespread method used until the advent of motor traffic.

Contracts in 1881 mention both flagging and macadamising:

A tender from Mr W. Carthy, of Templeogue, to supply green whinstone, suitable for macadamizing purposes, at 6s 6d per ton, delivered on the streets... accepted...¹⁰

Tenders from Mrs Anne Donnelly and Mr James Doyle, to supply granite flags at 6s 8d per yard... accepted... A tender from Mr. J.C. Meyers, of Rathgar, to supply broken Bohernabreena green stone for macadamizing purposes, at 6s 6d per ton, delivered on the streets... accepted.

Footpaths could be either flagged, gravelled or asphalted in this period:

The pathway opposite Frankfort-terrace and Madras-place, Phibsborough, were ordered to be included in the list of those to be asphalted; and the footway at Arranmore-terrace, and from Dorset-street to Mountjoy Prison, were ordered to be gravelled.¹¹

... an application from the Deputy-Surveyor was submitted to your Committee, asking for the necessary plant for repairing, etc., of tar pavement, and stating that with his own staff he could lay a very good asphalte pavement, costing 2s per yard, and that the mixture which he had laid down consisted of tar, pitch and lime, which he found stood the heat better than either Limmer or Mineral Rock Asphalte...¹²

⁶ Patrick Wyse Jackson, *The Building Stones of Dublin: a walking guide* (Dublin, 1993), p28.

⁷ Encyclopaedia Britannica 1911.

⁸ Report of the Paving, Cleansing and Lighting Committee, December 1880, p333

⁹ Report 1880, Vol. 3, No. 220, p485.

¹⁰ Report 1881, Vol. 1, pp216-7.

¹¹ Report 1881, Vol. 2, p168.

¹² Report 1881, Vol. 3, p93.

In 1900, timber paving blocks were in use:

Having received a report from the Borough Surveyor, pointing out the absolute necessity of at once securing a supply of about 70,000 wood paving blocks, in order to be able to proceed with certain pressing services throughout the City, where the laying of wood pavement is necessary...

The tender accepted was that of The Acme Wood Flooring Co., Limited., Gainsborough-Road, Victoria Park, London, N.E., £11 5s per 1,000 Jarrah wood blocks, 3 inches by 9 inches by 5 inches, delivered in Dublin; and £10 12s 6d per 1,000 Jarrahdale blocks of similar size.¹³

Timber paving was used each side of the City tram tracks in order to reduce noise as a 1915 report of the Paving Committee by Norman Chance, Assistant Engineer explains:

In the estimates for the year just expired provision was made for laying wood pavement in Dame Street, on either side of the tramway lines between Palace Street and Exchange Court. We decided to devote the money thus provided to continuing the much more valuable and urgent work of repaving Sir John Rogerson's Quay. Various considerations... Firstly, wooden paving on a narrow strip at each side of the tram rails in this portion of Dame Street would be very expensive to maintain, and it would not have the desired effect of reducing noise, since at least one wheel of each vehicle would be on the stone setts; Secondly, the gradient at this point is very steep... postpone the work until a general repaving of Dame Street and Cork Hill takes place.¹⁴



Road repair works underway on Saint Stephen's Green at the top of Grafton Street, Dublin c.1900 (Lawrence Collection, image courtesy of the National Library of Ireland)

Decline of traditional paving methods

THE ADVENT OF MOTOR TRAFFIC

The Paving Committee report of 1915, by Assistant Engineer Norman Chance, provides considerable insight into the condition of the pavements and techniques employed in the early part of the twentieth century, when the advent of motor traffic was about to completely change the appearance of streets:

... from the year 1885 to 1898 the Corporation spent very large sums (over £400,000 in all) out of loans on street works. As the life of such works is about twenty years it is obvious that a great deal of the paving laid at that time is in need of renewal.... Large number of central streets that they know to be in bad order...

Regarding "Works":

... Paving and Macadam being increased by about £1,800 each, and Flagging and Concrete Footways being correspondingly reduced... I have only to point out that as Russia, France, and Germany are at war, it will certainly be unusually expensive and, perhaps impossible to secure supplies of wood and asphalt for paving purposes.

Reference is also made in the 1915 report to the practice of spraying tar on the surface of macadamised roads to create tar-bound macadam (the origin of the modern word 'tarmac', now generally misapplied to asphalt roads). With the advent of fast-moving motor vehicles, dust had become a serious problem on water-bound macadam roads. The vacuum created by rubber tyres sucked dust from the road surface, creating dust clouds and causing gradual ravelling of the road material.

... The benefits of tarring have been pointed out by many authorities, including the Road Board, and already the life of many of the roads treated in the City with tar has been considerably increased thereby. Its application to roads of heavy traffic has, however, been somewhat a failure...

¹³ Report 1900, Vol. 1. No. 7, Report of the Paving Committee.

¹⁴ Report 1915. No.102. Report of the Paving Committee, pp973-4

The report contains an assessment of the practicality of flagged pavements and shows that the introduction of concrete flags and of poured in-situ concrete had begun by 1915:

... the cost of flagging has received considerable attention from successive Committees, but it is still difficult to justify its employment on the score of economy alone. Cost of redressing existing flags is about 10s per yard. It could be replaced with asphalt on a concrete foundation for about 6s 6d per yard, or with artificial concrete flags at about 7s per yard. Each of these pavements for footways has its own particular advantages. The advantage of flagging is its considerable life. It has, however, the disadvantage of being a somewhat dirty form of paving and not particularly suitable where the footway is over cellars over which an impervious cover would be desirable. The asphalt footway has every advantage, including a reasonably long life, but it is not as durable as flagging. The disadvantage of concrete in situ footways is that they are greatly damaged by openings made in them. The first cost, of course, is low, and the life is long. The artificial flags have been largely used in England...

Concrete paving began to be used for pavements from the early part of the twentieth century. Until the late 1980s, historic granite footpaths were routinely replaced with concrete paving. In these repaving schemes, historic paving was often re-laid or left untouched outside pubs, where delivery of beer kegs demanded a more robust material.

As motor traffic became widespread, asphalt or tarmac and also poured concrete became the norm for roadways, and many setted surfaces were dug up and replaced, or were simply covered over.

The restoration of setted carriageways was a key feature of the successful revitalisation of the Temple Bar area of Dublin in the 1990s and these are now perceived by residents and visitors alike as an essential element of the heritage of the city. However, many of these setts were moved to the area from other parts of the city and this practice is unlikely to be considered appropriate today, particularly if the location of the setts is original. Likewise the granite pavements which survive to a degree throughout the Georgian areas of Dublin are now identified as a characteristic feature of the city and their role as an essential component of the iconic eighteenth-century architectural ensembles.

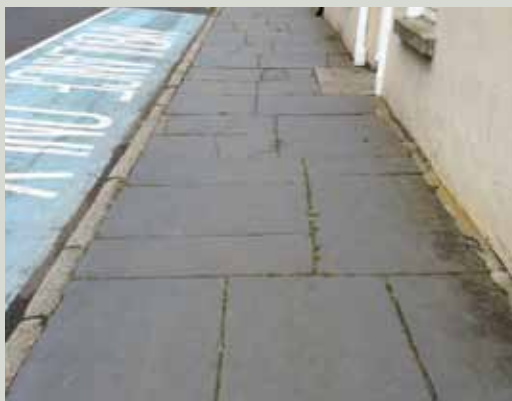


Granite flags and kerbs retained outside a public house on Chancery Place, Dublin

2. Paving Types and Characteristics

Flagstone paving

In many parts of the country, limestone was the predominant material for paving flags and kerbs. Examples of limestone flags can still be found in many towns. Some types of limestone can be problematic when used for paving as they develop a high polish from continued use and tend to become slippery. For this reason, many such pavements have been replaced on public footpaths. In parts of County Clare, flags of local sandstone from the townland of Luogh can be found. Flags of Luogh sandstone were also used locally as a roof covering.



Limestone flags in Monasterevin, County Kildare

In eighteenth-century urban development, the provision of paving was considered not only to be convenient but to add to the prestige of a neighbourhood. For example, leases pertaining to the construction of the Georgian terraces of Merrion Square stipulated that a fine quality of paving was to be laid to the front of each building as part of its overall development. The Fitzwilliam family, which developed the Pembroke Estate in south Dublin, had its own quarry at Ticknock, in the foothills of the Dublin Mountains, which supplied stone for construction work. Apart from some isolated examples of imported Yorkstone flagstones, the vast majority of historic footpaths in Dublin are paved with Leinster granite flagstones of varying in size in a bonding pattern, that is, with staggered joints similar to brickwork bonding patterns. These granite flagstones originated from a host of quarries in County Wicklow, south County Dublin and County Carlow.



Granite flagged pavements are found in several towns along the east coast, including this example at Commercial Quay, Wexford

Although historic flagstones have been lost in most areas, wide granite kerbstones measuring approximately 300mm in width, and varying in length are still widespread throughout the city centre of Dublin. Granite kerbstones are also found in towns along the east coast in combination with either granite or limestone flags or, more commonly, with replacement paving such as concrete flags. Narrower granite kerbs are common in Victorian residential areas and on side streets, usually used in conjunction with monolithic poured concrete pavements which replaced earlier gravel or cobbled footpaths in the twentieth century. Flagged pavements and kerbs often display rich details of great interest, such as stepped kerbs in inclined streets, rounded kerbs with radial or concentric details at corners, or cut-stone gutters or drains. The variety of bonding patterns in surviving sections of historic paving is evident on closer study, for example details to corners and to the surrounds to basement cellar openings and pavement lights were approached in different ways. These variations are likely to have arisen out of the need to achieve the most efficient use of the random lengths of the stone available and the discerning eye and skill of the stone mason involved in the original laying out of the pavement.



Stepped radial paving at Cork Hill, Dublin. The originally tooled slip-resistant surface has worn down to a smooth finish which exposes the buff-coloured structure of the granite adding richness to the visual quality of the street in particular when it is wet

Cobblestone pavements

One of the earliest means of paving a surface for vehicular traffic was the use of rounded stones gathered from beaches or river beds. These undressed stones, or cobbles, are often egg-shaped and naturally occurring and should not be confused with setts which are squared, worked stones.

Paving with cobblestones was generally restricted to towns and other heavily trafficked areas and allowed a surface to be used all year round. Cobblestones were also commonly used to pave courtyards, farmyards and stableyards. Cobblestones were set, pointed end downwards in sand or directly onto earth, and were packed tightly together or bound with mortar. They were generally laid at right angles to buildings to ensure that surface water drained away from the base of a wall to avoid saturation. Broken or roughly hewn stones were also used, and early minutes of the Dublin Paving Board refer to 'sound pebbles or paving stones free from shakes or splinters, which will bear hand trimming not less than four inches over each way.' Today, cobbles have disappeared from most city streets, and are now more often seen in footpaths, laneways, gutters at the edges of roadways, courtyards and farmyards, and where heavy vehicular traffic is rare.

Traditional cobbled paving cannot withstand heavy modern loads such as trucks. However, cobbles set in sand have the structural advantage of flexing rather than cracking with movements in the ground. They have the environmental benefit of being permeable pavements, allowing rainwater to drain away into the ground through the joints, thereby reducing the volume of water run-off.



A decorative, but functional, layout of cobbled paving in County Galway



Cobbles used in a laneway in Kilkenny

Setted pavements

STONE SETTS

Setts are cut blocks of hard stone laid on edge in regular patterns to provide a surface of higher load-bearing capacity than cobblestones. By the beginning of the twentieth century, setts had been laid in the roadway of most major streets in Irish cities. These have by now disappeared from the main thoroughfares, but often survive in smaller streets, service lanes and in docklands and other industrial areas such as around the Guinness Brewery and Power's Distillery in Dublin, and on Custom House Street in Cork. In some cases, original setts may survive beneath a later road surface.



Green diorite setts in North Lotts and granite setts at Haymarket, both in Dublin. The consistent size of the setts and the narrow joints are characteristic of the original craftsmanship that went into laying these pavements

Setts were often made from whinstone - a general term used to describe harder igneous rocks which were more suitable for this purpose, commonly of dark stone such as basalt, dolerite or andesite. Many of the surviving setts found in Dublin are of Arklow diorite, an igneous rock composed of feldspar, a green component called hornblende and mica. Though appearing black at first glance, the actual dark-green colour can be clearly seen when they are wet. Examples with smooth well-worn surfaces can be seen in Foster Place and the North Lotts, Dublin. Other setts found in Irish cities were imported from Scotland and may include dolerite and granite, and possibly basalt, alongside stone from Wales.



Gutter detail in North Lotts, Dublin

Setts vary in size depending on the source of the material. Diorite examples can be approximately 95mm x 165mm to 235mm on the visible face, and 150mm in depth; while granite setts of reddish colour can measure approximately 80-90mm x 150-180mm.

In Ireland, rectangular setts were mostly laid in a stretcher bond pattern, generally running perpendicular to the direction of the roadway, but also diagonally as seen at Haymarket and Smithfield in Dublin. Square setts laid in segmental or fan patterns, common across continental Europe, are rare in this country, though examples survive at Custom House Street and Rockboro Road in Cork, perhaps attesting to the influence of direct trade connections to the Continent.



Stone setts dating from c.1815 adjacent to a bonded warehouse complex in Cork City. The fan-shaped pattern used in the layout of the setts is unusual in Ireland and may point to the involvement of continental workers

The beauty and attention to detail of the traditional sett-layer's craft can be seen in the various details and junctions and in the way in which gratings and covers were integrated into the layout. These details add great richness to the urban environment. Interesting junction details occur where streets meet at oblique angles and various gutter details enhance the variety of the streets. In some cases, the bond terminates against a kerbstone, in others a gutter is formed of two or three parallel rows of setts. In cases where no footpath exists, an edge band of the same level and bond is demarked by a channel running parallel to the street. In some instances, a setted gutter survives where the carriageway itself was not setted, or where the carriageway setts were replaced with asphalt or tarmacadam. Wide flags were often laid into the setted surfaces as wheel tracks or to provide road-crossing routes for pedestrians.

Setts were split rather than cut and the rough vertical faces laid in contact to each other, causing a tight surface joint of approximately 15mm. Contact between the setts is structurally important in traditionally laid pavements as the matrix of stones acts in compression to form a structural unit. If not locked together in a bonded pattern with surface contact to other setts, individual stones can come loose and cause the surface to unravel. To ensure contact between stone courses, setts of varying width were traditionally sorted into rows of equal size and this work required skill and experience. The tight joints and variety in row width further enhances the visual beauty of the paving. Joint widths became tighter during the course of the nineteenth and into the twentieth century as the production of setts became more precise. In examples seen in Edinburgh, joints were reduced to an average width as small as 6mm.

TIMBER SETTS

Setts of timber were also used and where they survive they are a very rare feature and every effort should be made to protect them in situ.

Timber setts were usually laid along tram lines and beneath carriage arches in order to deaden noise from the horses' hooves. They were also found on streets around buildings such as hospitals and courthouses, where noise would cause nuisance. In some instances, they are reported to have been used where the sparks created from the horseshoes or metal wheel trims striking on stone had the potential to ignite nearby flammable materials.



Some rare surviving hexagonal timber setts in the archway leading to Front Square in Trinity College Dublin

Concrete flags

In the second half of the twentieth century, precast concrete paving slabs, either square or rectangular in shape, were used to replace historic granite flags. Similar to the stone flags they replaced, they were laid in a bonded pattern usually retaining the original granite kerbstones. At the kerb, 900 x 600mm concrete flags were used in alternating rows to create the offset in the bond, giving the pavements a generous large-format effect, reflecting the character of historic pavements. Similar concrete paving is still used in many areas, but the 900 x 600mm slabs are now only used where cutting of 600 x 600mm slabs would lead to very small units, and the typical kerb junction has a half slab of 300 x 600mm in alternating rows, giving a less generous effect.



Concrete flags can be generous in size and laid in patterns similar to those used for granite or limestone flags. Good quality, smooth concrete flags wear well and can provide an appropriate setting to historic buildings



Examples of the skill and craftsmanship that is evident in traditional setted pavements

3. Planning Repairs to Historic Paving

As with buildings, the interest and significance of a historic ground surface is higher if it is authentic, that is, if the original material survives undisturbed in its original location and retains the evidence of the craftsmanship and skill that went into its making. Historic paving can be divided into three levels of significance:

1. Of highest significance is paving which has survived undisturbed, so that the original laying pattern and construction detail may still be appreciated. Such surfaces are quite rare and should be given the highest level of care and protection. Aside from their beauty, these surfaces have great historical and archaeological value recording historic techniques and attesting to the skills and craftsmanship of the time in which they were laid. The value and appeal of such surfaces is diminished if they are taken up and re-laid. This is particularly true in the case of groups of setts which were worn down together in situ to form an evenly smoothed surface. A finish like this cannot be reassembled to achieve the same quality and authenticity. If the paving in its current location has previously been undisturbed, it should only be moved in exceptional circumstances.



Examples of authentic historic paving, such as these setts, often survive intact beneath the present road covering. Their location should be recorded to prevent damage and, where possible, they should be uncovered and conserved

2. Historic surfaces which have been lifted and re-laid in their original location are also significant. This is often the case with historic paving in city streets. Although the traditional laying pattern and technique may have been lost, such paving retains its value and significance as the material and

location are authentic. It is important that paving of this type should be conserved in the same location. In some cases, historic paving may have been re-laid with modifications such as to include access covers or to create dishings. When works are proposed to such paving, the opportunity should be taken to reconfigure later incongruous layouts to ensure the paving follows traditional patterns.

3. Paved areas which have been reinstated using salvaged material from elsewhere are also of interest. Although not historic, such surfaces can make a contribution to the quality and texture of a street and to the setting of buildings, particularly if there is historical evidence for such paving in that area. The materials and craftsmanship that went into the creation of the paving elements survive regardless of the fact that they have been moved from their original location. In these cases, it is the material, rather than the location of the paving that is of significance.

Getting the right advice

When considering works to historic ground surfaces, advice should be sought in the first instance from the architectural conservation officer, from conservation architects within local authorities, or from a conservation professional. In order to ensure work of high quality it is important that there should be conservation expertise employed throughout the process, at survey, design and specification stage and in overseeing the works on site. The skills of an experienced stonemason may also be necessary in planning and carrying out repairs.

Conservation principles

Everyday features such as paving and street furniture do not merely form the setting of historic buildings but are heritage assets in their own right. As such, authenticity in form and materials is just as important in the case of historic paving as it is for any part of the built environment. When applied to paving, the basic conservation principles are:

- > Understand and record the site prior to any works. Before undertaking repair work study the detail and evolution of the paving to inform all further decisions. Record all historic details where the paving is to be lifted, such as the rhythm and bond pattern of the original paving
- > Respect the importance of original location, context and historic setting
- > Retain the original fabric and, where changes are demanded, keep these to a minimum. Avoid disturbing historic paving if at all possible
- > Do not re-lay large areas to achieve visual consistency if this would mean losing an authentic worn or undulating surface
- > Make alterations sensitively, having regard for the spirit of the original historic craftsmanship
- > Follow the historic layout, bonding pattern and junction details where surfaces are to be re-laid, and maintain the same joint width and pointing detail. Where paving is to be reinstated and the original design is not known, replicate historically correct layouts known from similar locations
- > Use historic materials and traditional skills in repair work, supported by modern techniques where traditional methods may prove inadequate
- > Where greater bearing capacity is needed, devise a modern sub-base which allows the paved surface to retain its historic appearance while avoiding future damage
- > Where re-laying of surfaces is unavoidable, retain historic material in the same location
- > Ensure that any re-laid surfaces fall away from a building to ensure that the walls and foundations do not become saturated by water
- > Ensure that modern alterations or additions are visually identifiable and reversible

Lifting historic paving

The lifting of previously undisturbed paving should be avoided. Where it is necessary to lift all or part of a historic paved surface, it should be recorded prior to any works taking place. Before any works are undertaken to lift such paving, extensive consultation will be needed to ensure that agreement is reached with all the relevant stakeholders, particularly where the pavement forms part of the public realm. In some cases, archaeological testing in advance of proposed works or monitoring of the works in progress by an archaeologist may be required and the advice of the National Monuments Service of the Department of Arts, Heritage and the Gaeltacht should be sought in this regard.

SURVEY AND RECORDING

The level of recording should suit the extent of intended alterations. In some cases survey drawings may be needed, in others a photographic record may be adequate:

- > Where the lifting of historic flagstone or setted pavements is intended, the flags, setts and kerbstones should be numbered on a survey drawing and the individual stones numbered with a water soluble marking to allow for the correct reinstatement of the paving
- > The dimensions of the flagstones or setts should be recorded, noting in particular their proportions, bonding pattern and also the thickness of the stones
- > Particular details and arrangements such as at corners, basement lights, coalhole locations should be identified and recorded
- > Any special stones that have been shaped to fit a particular location or to undertake a particular function should be identified and recorded
- > The existence and location of previous alterations should be recorded where the coherence and integrity of the original bonding pattern was lost or disturbed in earlier poorly conceived interventions
- > Where cobbles are to be lifted, the arrangement and jointing detail should be recorded with photographs and sketches to allow for correct reinstatement

- > Where setts are to be lifted, the bond pattern should be recorded showing the placement system of setts of varying size, sorting into rows, width of joints, gutter details, edge conditions, camber of road surface, and falls of inclined borders. In areas where a group of setts have been evenly worn over time, it may be necessary to record and number the setts with removable markings, so they can be re-laid in correct order to reinstate the patina
- > The type of stone used in setted surfaces should be documented to avoid incorrect mixing of materials in reinstatement work
- > All historic gratings or other covers should be documented, including their positions and the arrangement of paving stones around these elements
- > Records should be filed in a systematic way for reference during reinstatement and for archival purposes

During the works, the historic construction technique should be recorded and, where appropriate, bedding or jointing materials should be analysed. A camera should be kept on site to record any features of interest uncovered as more information may come to light during the progress of the works. The architectural conservation officer should be consulted where unusual features, such as earlier surfaces, are uncovered during works.



Significant details should be recorded such as this example of the manufacturer's name inlaid in brass into a concrete flagstone

LIFTING OF FLAGSTONES

Lifting of historic flagstone pavements should be a last resort, particularly where a historic surface has never previously been disturbed. Where lifting is unavoidable it should be done in the following manner:

- > Historic surfaces should be recorded, as above, prior to any lifting by means of drawings or photographs. The level of recording should suit the extent of intended alterations. The record should make a distinction between historic paving and later modifications. Reinstatement of incongruous modified layouts should be avoided
- > Where historic paving is intact and has not previously been re-laid and lifting is unavoidable, paving slabs and kerbstones should be reinstated in their exact location and laying arrangement. Flagstones and kerbstones should be numbered with weather-resistant removable markings to facilitate correct reinstatement
- > Lifting of historic paving should be carried out by trained and skilled masons. It should be noted that historic flagstones and kerbstones are often considerably larger and heavier than modern units and may be in excess of current manual handling limits. This should be anticipated and taken into account in the methodology drawn up for the proposed works
- > Taking up of paving units should be closely supervised to ensure no damage is caused. Power tools should not be used because of the potential damage that they can cause. Double-handling of historic elements should be avoided wherever possible
- > Great care should be taken in removing any cement pointing around stone slabs to avoid damaging the arrises of the stones
- > Cracked or broken slabs or kerbs should be reused where possible. Slabs with clean breaks should be fitted together in their original form. Where edges are badly damaged, redressing by a skilled mason may be considered appropriate in order to enable reuse of a kerb or flagstone
- > Where historic paving slabs or kerbstones have been previously re-laid it is likely that the layout is not historic, and it is possible that slab edges have been damaged by repeated lifting and repointing, or by earlier use of cutting tools. In such cases slabs may require redressing by a skilled mason, and better layouts should be devised

LIFTING OF SETTS AND COBBLES

Previously undisturbed areas of historic setts or cobbles should only be lifted in exceptional circumstances. Although less susceptible to breakage than flagstones, setts and cobbles nonetheless require to be lifted with care. Traditionally laid stones can be lifted easily without damage using a front-loader with a shallow rubber-toothed bucket lined with clay. Setts and cobbles laid in rigid construction are more difficult to lift. These should be lifted manually, taking care that the surface comes apart by breaking the joints rather than the stones themselves. Joints should be raked out, where possible, to their full depth taking care not to damage the arrises of the setts or to shatter the stones.



Setts laid in tar being taken up prior to being re-laid

Cleaning and storing lifted paving elements

Prior to storage, paving elements which have been lifted should be cleaned of all bedding and jointing materials and any other materials adhering to them. The latter may include paint from road markings or graffiti, chewing gum and other deposits.

Where space can be accommodated safely on site and where there are no security issues, it is preferable that paving materials be stored on site. This reduces the handling of the historic paving elements and thereby lessens the risk of damage or breakage. Where kerbside parking exists, parking spaces may be used for such storage, if road safety allows.

Historic slabs, setts, cobbles and kerbstones should be laid on pallets and evenly supported to prevent breakage. The supply of such historic hand-crafted material is limited, therefore care should be taken to avoid damage. Large granite slabs can be very brittle and it may not be possible to stack them. Where transport off-site is necessary, slabs should be placed evenly on pallets, covered and taken directly to the relevant depot. Salvaged setts to be stored should be sorted by stone type for reuse in homogenous surfaces of one stone type. Setts should be stacked on pallets rather than in heaps, and should never be tipped. Historic setts should never be broken up or disposed of.

The storage facility should provide clean, dry conditions, free of contamination. The stones should be stored clear of the ground. An inventory system should be used to record the locations from which all stones were taken. Storage should be organised to ensure that paving is returned to its original location.



Lifted granite flagstones being prepared to be taken off site temporarily for storage



The repair of this radial corner will be labour-intensive work and require particular skill to repair correctly

Traditional building skills

Understanding the traditional skills of an experienced stonemason is invaluable to the interpretation, planning and remaking of historic paved surfaces. Contractors and their operatives engaged to work on historic surfaces should be required to display proficiency and experience in traditional building skills. Building professionals who oversee such projects should be aware of all conservation issues involved. Typically general contractors have not the necessary skills and experience to make decisions on working stone into place nor sufficient experience of stone laying to recognise the intent of the bond pattern of the original stone mason. The involvement of a skilled mason in the planning and execution of re-laying historic paving is essential in order to conserve this diminishing resource and tradition.

To ensure that adequate standards are met, detailed conservation methodologies should be included in any tender documentation, and specifications should take account of best practice recommended in this guide.

Structural principles of paving

Structurally, pavements can be made up of the following layers (from the top surface down):

- > Surface layer (paving)
- > Bedding layer (or laying course)
- > Base (included in bound construction only)
- > Sub-base (the load-bearing layer)
- > Sub-grade (existing ground layer)

The nature and design of these layers will determine the loading a pavement can sustain. Structural capacity is influenced by the shape of the stone units chosen, the layout and gradient of a street, the weight and frequency of vehicular traffic, as well as the travel direction over the pavement. Construction methods can be categorised according to structural behaviour as:

- > 'Flexible' surfaces on unbound sub-bases, which deform in an elastic manner under load and revert to their original profile once the load has passed
- > 'Rigid' surfaces on bound sub-bases, which are not intended to deform under load

Flexible constructions typically fail under fatigue, the cumulative effect of repeated loading, and a well-designed unbound sub-base is needed to meet the structural demands of the particular situation.

Rigid constructions typically fail under a combination of heavy single loads followed by fatigue. They can be designed to sustain high loads over long periods provided the integrity of the surface is not compromised during their life. Movement joints are needed at regular intervals in rigid pavements.

Prior to the availability of strong binders, such as Ordinary Portland Cement, ground surfaces were constructed in the traditional manner as flexible surfaces laid on sub-bases of unbound aggregates. These surfaces deform in an elastic manner under load and revert to their original profile once the load has passed. While flat flagstones can only sustain lighter loads, setted roadways on unbound sub-bases were constructed to withstand considerable loadings and can be very resilient.

Flexible construction has several advantages: flexural strength, lower material cost, suitability to phased construction, and the absence of curing period for concrete or cement allows early reopening of a road or footpath to traffic. Flexible paved surfaces are easier to repair effectively, and loss of surface profile can be rectified simply. If jointing of the paving units has been carried out correctly, paving can be lifted and re-laid seamlessly following opening up and all surface components can be reused when modifications or repairs are needed. Unbound paving can play an important role in achieving a permeable pavement which can reduce surface water run-off by allowing at least some storm water to percolate through the paving to the water table.

To protect historic paving, restrictions on allowable loading may be required. Different loadings should apply to setts in roadways than to flagged footpaths. Kerbs and vehicular access points across footpaths, which are subject to greater loading, require a sub-base of structural design to accommodate this traffic.

Where paving is reinstated or needs to be renewed, account should be taken of the worst-case loading and the sub-base and surface layer designed accordingly. In certain cases rigid construction may be appropriate.

4. Repair of Flagstone Pavements

Structural capacity of flagstone paving

The shape and form of a paving unit influences its structural capacity and determines the form of construction most suited to it. Historic flagstones are essentially flat, that is, their depth is small in proportion to their plan area, and for that reason they are not very resistant to vertical loading and will fracture more easily under a directly applied load than setts which are smaller and deeper. Flagstone surfaces are therefore not suited to vehicular traffic and so, historically flagstones were generally used on footpaths. A paved surface composed of shallow flagstones acts in a different way to a surface made up of deeper stone units. Flagstones depend more on the bedding in which they are laid for stability. The individual units do not act together to resist loads and the joints play little role in structural performance.

Support layer for flagstone footpaths

In flexible construction, the support layer consists of the sub-grade (existing ground) and the sub-base (the load-bearing layer). The sub-grade must provide an adequate surface for compaction of the sub-base. If the sub-grade has a high clay content, a geotextile separator should be laid to prevent the material of the sub-base from sinking into the sub-grade. The thickness and make-up of the support layer should be designed for the required load. It should be well compacted at optimal moisture content, and this requires well controlled site practices. The support layer must be compatible with the paving or surface layer, i.e. a flexible surface layer requires a flexible support structure.

Ideally, granite or limestone flags should be bedded in the traditional manner on a support layer of thoroughly compacted sand. There are several reasons to recommend this method:

- > It creates a pavement of greater flexural strength than those of rigid cement-bound construction

- > It is environmentally more sustainable, as it provides a permeable pavement which contributes to the minimisation of storm-water run-off
- > It reduces damage by frost action
- > The absence of cementitious materials prolongs the life of the paving slabs and reduces damage to the edges of slabs brought about by hard pointing materials
- > Staining of natural stone with cement is avoided
- > Slabs can be more readily taken up in the future, if necessary, limiting damage to historic flagstones

Where frost action is likely to occur, it should not be possible for penetrating moisture to be trapped within the frost layer. All parts of the construction should be permeable and adequate positive drainage provided if needed. Frost protection is a further reason to favour flexible unbound construction in climates with cold winters.

Bedding of flagstone footpaths

In flexible construction the bedding layer, or laying course, consists of unbound sand aggregate. The bedding layer should not be too deep and should consist of sharp sand of graded particle size. It should not be too fine and building sand with rounded particles should never be used.

When laying modern flagstones of equal depth the bedding layer can be prepared as a screed bed, spread on the sub-base and compacted with a plate vibrator. Historic flagstones of varying depth cannot be laid in this way and require individual bedding, compacted with a rubber mallet. This process requires considerably greater skill than screed bedding and mechanical compaction. Care should be taken and judgement exercised to ensure that the irregular underside of each unit is evenly supported on the bed and well compacted. 'Spot bedding' with mortar should never be used, as this does not provide uniform support and leaves voids beneath the flags, leading to uneven settlement, rocking and potential cracking of flags.

Joints should be filled on the same day with dry jointing materials, brushed over the surface. Once joints are filled, the surface can be further compacted using a plate vibrator fitted with a neoprene shoe. The process of filling joints and compacting the surface should be repeated until the integrity of the surface has been established.

Kerbs as edge support

Stone pavements in flexible construction require edge restraint robust enough to withstand all expected traffic, including construction traffic. Edge support is needed at the pavement edge and around all openings in the pavement. Consideration should also be given to the differential movement of adjoining road surfaces which can affect the pavement.

Edge restraint of historic footpaths is normally provided in the form of wide granite kerbstones. Even lightly trafficked pedestrian footpaths may demand rigid support for kerbs. This should be designed to suit the appropriate pavement loading, but should extend in depth to at least beneath the laying course.



Granite flags at Mark Street, Dublin with wide kerbstones

Where vehicles are likely to drive onto kerbs, cement-bound support is necessary beneath the kerb. Cement-bound supports do not withstand loading from large vehicles over the longer term, and this is a particular issue at street corners where large vehicles turning the corner can drive onto the kerb causing the breaking and cracking of kerbstones. Specially designed concrete foundations may be necessary where a lasting support layer is required. A better option is to institute changes in traffic management to avoid situations that would result in damage occurring to historic paving.

Joints in flagstone pavements

Many surviving pavements have been re-laid at some point in their lives and, of those re-laid in the past 50 years, most have been pointed with sand-cement mortar. A visually over-prominent strap-pointing technique was frequently used but has now been discontinued in most new work, in favour of a struck flush-pointed detail, with measured success. However, the use of artificial cement in mortars remains problematic because its strength and impermeability can damage the adjacent stone.

The material, colour and detail of joints all have a profound effect on the visual quality of historic paving. Traditionally, joints in pavements were open and filled with fine sand. Recessed joints allow the edges of the slabs to be seen and this is aesthetically the best detail.

Historic flagstones often have irregular edges and eroded arrises caused by earlier pointing and in some cases joints may be considered too wide to be left unpointed. When pointing, it is important to select a sacrificial jointing material, that is, one which is weaker than the host stone and which will absorb any thermal and structural movement, thereby preventing damage to the historic flagstones. A lime-based mortar is the most suitable for this purpose. Where an area of paving cannot be cordoned off long enough to allow lime mortar to set properly, a natural cement may be added to the mix to accelerate the setting time. This also strengthens the jointing material to better resist the wearing effect of motorised cleaning machines used in some urban areas.

It is important that artificial cements, such as Portland cement, are not used in joints. Natural stone flags do not have the strength of concrete, and it is better to have a porous breathable jointing material to allow drying out through the joints. Hard impermeable joints cause erosion of stone edges due to retention of moisture coupled with frost action over time.



Slightly recessed joints allow the uneven edges of the historic flags to be seen which enriches the character of the paving. However, they have the disadvantages of catching dirt and small pieces of litter and allowing the accumulation of water which may make them unacceptable in some circumstances

Modern engineering specifications often call for bedding and jointing to be carried out as a single operation. This is not appropriate when dealing with either historic surfaces or natural surfaces, particularly if a cement mortar is being used. This 'slurry' method is favoured for its speed and requires little technical skill. However, when dealing with historic paving, the difference between jointing and pointing and need for a two-stage approach should be clearly distinguished.

A variety of inappropriate pointing details can be seen to have been applied to historic pavements across the country. Strap-pointing of slabs with raised bands of sand-cement mortar covers the edges of the individual flagstones and causes the pointing to be the visually dominant element of the footpath.



Inappropriate pointing: these four examples show crudely applied pointing using methods and materials which are inappropriate for historic paving. The use of cement-based mortars will damage the stone in the long term whilst the damage to the visual appearance of the paving is immediate.

Flush-and-struck pointing is often inconsistently applied and also covers the edges of the stone. Unsuitable dark aggregates are sometimes used producing a mortar unsuitable for use with a lighter coloured stone. Aside from aesthetic shortcomings of these details, the use of hard sand-cement mortar is technically damaging. Rigid joints will not absorb the level of movement which is inherent to a flexible historic pavement causing cracking to occur in the host stone, and crumbling of the pointing mortar. Further damage is caused to the slab edges when this hard mortar needs to be replaced. Cement mortar also prevents the drainage of excess rainwater through the joints.

The following pointing details are recommended:

- > Joints should be visually subservient to the paving slabs
- > Ideally, fine sand-filled joints should be used. The sand should be a sharp aggregate of a colour and character appropriate to the colour of the stone, brushed into the joints and thoroughly compacted. Joints should be topped up in early life as the aggregate 'shakes down' and stiffens
- > In more demanding urban environments joints may be pointed with a naturally hydraulic lime mortar, which will withstand movement, and will have a lighter colour more suited to granite and limestone paving. A suitable mix would consist of one part naturally hydraulic lime to two parts sharp/crushed sand of suitable colour, graded from 3mm down to dust. Traditional methodologies should be followed in this work to ensure effective curing of the mortar
- > Where pavements require to be reopened for use without excessive delay, a balance must be struck between setting time and flexibility of the joint. A typical mix in such cases might consist one part natural hydraulic lime to five parts sharp sand and gauged with one part natural cement
- > Good quality sharp sand should be used in lime-based mortars. Sharp aggregate of buff-grey mix enhances the colour of the joints and adds texture to wide joints. Aggregate should be exposed by beating the finished joint with the stiff bristles of a brush

Where pavements have previously been pointed, the arrises of the flagstones may have become rounded or damaged, and a flush-pointed joint would be very wide at the surface. Broken corners and edges cause further localised widening in the joints. Two options for jointing such flagstones are possible:

- (i) A recessed joint, visually the preferred detail as the edges of the paving slabs are not covered by mortar and the joint is relatively narrow, or
- (ii) In some urban settings flush joints may be preferred, as they are easier to keep clean. If flush joints are chosen, the colour and texture of the material should be carefully selected as the impact of the wider flush joint on the overall pavement is much greater.

Vertical joints in kerbstones are vulnerable to damage and are therefore better recessed, especially where kerb edges are rounded and worn.



These images show the effects of different pointing methods on the same area of paving; in the top image the joints are recessed, while in the bottom one the joints are flush, or marginally recessed, using a light-coloured mortar

New stone for replacement flagstones

In repairing damaged pavements, new stone may be required where broken slabs cannot be reused. Even in granite areas, imported granite is often used as a replacement material, as the original sources of native granite may no longer be in commercial operation or have limited supplies. Although considerable time and effort is sometimes made to achieve a roughened surface, the colour of imported stone is rarely a satisfactory match. Other issues to bear in mind include:

- > For smaller repairs, a matching native granite may be available in limited quantities and should be obtained instead of imported granite
- > For larger areas of replacement or reinstatement in historic areas, quarry owners may facilitate the temporary re-opening of quarries
- > Historic bond pattern of flagstones should be followed and slabs of uniform size avoided. It is essential to look at a wide area of adjacent paving to achieve an understanding of the detail and pattern of the original construction
- > Edges of stone should be worked by hand to remove sharp sawn arrises or to address site constraints
- > Historic slabs should **not** be cut into smaller sizes
- > Where new stones are to be integrated into historic paving, the historic slabs should take precedence over the new inserts, and new material should be cut rather than the old. Historic slabs should never be cut or edges trimmed with power tools



Replacement flagstones of an even size have been used to match the historic ones. However, the colour match is poor and the appearance of the machine-made finish of the new flags is jarring



Replacement flags have been tooled to match the handmade texture of the historic ones



The use of power tools such as angle grinders should not be permitted in areas of historic paving. In this example, inexpert use has resulted in irreversible damage to the granite flags



Inappropriate sawn stone edges and sharp corners, in addition to poor colour matching, give a discordant appearance against the texture and softened edges of the historic granite



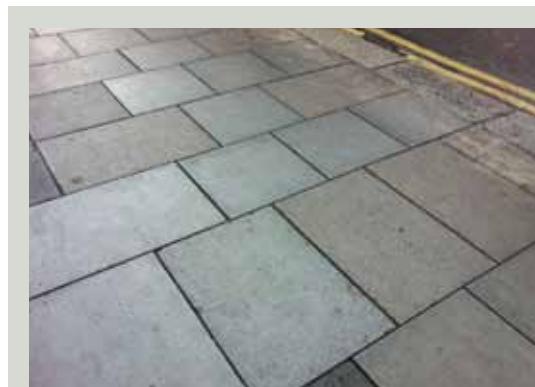
New inserts should follow the layout of the historic flags and not require the cutting of the existing stones as has happened in this case

A source of stone which is a good match for the historic flagstones should be found. Effective conservation to a high standard is not possible without access to good matching material. Small quantities can suffice for repair works and a higher material cost is justified in the context of the much higher labour cost for this skilled labour-intensive work.

The basic principle should be to retain historic paving elements in their location. Consolidation, that is the lifting of isolated flags and kerbs to make up a larger area of continuous stones elsewhere, should only be undertaken when isolated flags or kerbstones survive without context or when isolated stretches of kerbing need to be taken up for other justifiable reasons. Consolidation should only take place following agreement with the architectural conservation officer in the local authority. Areas of flagged pavements should not be moved.

Concrete flags

Some early examples of paving with concrete slabs are laid out and detailed to a high standard, particularly where 900 x 600mm slabs are used at the edges, and some have worn surfaces, exposing a fine aggregate. Although relatively recent, some of this material may be worthy of retention and should be treated with care. Where openings are made or areas re-laid, the original slabs should be kept and re-laid, rather than replacing them with new slabs. Roads maintenance inspectors should be made aware of these qualities and should protect them from damage by opening-up works.



Concrete flags laid in an offset bond with larger edge slabs

5. Repair of Setted Pavements

Undisturbed setted surfaces

A great many of the setted surfaces seen today have been re-laid and do not have the authenticity of undisturbed original paving. The quality of historically crafted setted surfaces depends to a large part on the even wearing which has been brought about by generations of traffic. Undulations and irregularities in the surface contribute in no small way to their character. Removal or disturbance of such historic surfaces should therefore only be undertaken with very strong justification. Where unavoidable, part of the paving may be lifted but only the part which is it is necessary to lift should be disturbed, retaining undisturbed areas.



Evenly worn diorite setts at John's Lane West, a rare finish, full of character, which is impossible to recreate with new materials

Areas of setts that have already been re-laid in recent decades do not have the same heritage significance as undisturbed ones. However, it is important that they should be retained. Where setted surfaces are to be reinstated these should follow patterns recorded in historically authentic areas. The opportunity should be taken to re-lay the setts with tight joints between the setts of a similar size to the original joint size.

New setts

Consideration should be given to the use of new setts of the same long format in reinstated areas, to be laid in stretcher bond in the traditional manner. This would allow the very limited supply of salvaged material to be kept in storage for repair works only, sorted by stone type.

Salvage of setts

Where setts are found beneath later surfaces, such as asphalt, these should ideally be left in place undisturbed and re-exposed following conservation work. However, if this is not possible, the setts should be re-covered in such a way as to allow for future uncovering without damage to the historic setts should the opportunity arise. Only in exceptional circumstances should the setts be lifted and in such cases they should be salvaged for reuse in repairs of other matching historic paving. The use of historic setts for other purposes, such as to create decorative edging to planting beds or to build landscape features, is a misuse of rare historic material and should be avoided.

Structural capacity of setts

The action of setts is fundamentally different to flagstones in that the individual stone units can sustain high vertical loads, and the paved surface derives its stability from contact between setts as well as the bedding.

Traditional setts were split rather than cut, and the rough vertical faces were laid in 'dry-bound' manner in contact to each other, the matrix of stones acting in compression to form a structural unit. The bonding pattern is important as it locks each sett into position so individual stones do not come loose and cause the surface to unravel. The joints were filled with fine sand and setts were laid on flexible sub-bases which have been proven to sustain very high loads. Examples surviving in industrial areas such as in Dublin around the Guinness Brewery, notably Robert Street, have continued to sustain heavy loads without deformation or failure and demonstrate the high load-bearing capacity of historic setts laid in the traditional flexible manner.

In other countries, such as Germany, setts continued to be used and maintained throughout the twentieth century, while their use died out in Ireland. German sources confirm the enduring structural resilience of traditional setts and assert that the structural capacity of a setted surface lies in the design of the support layer. Loads are passed through the surface layer and, if adequately supported, the paving can withstand even the heaviest traffic as long as it is correctly laid and bedded.

Rigid construction used with historic setts has the following disadvantages:

- > In severely loaded sites, rigid surfaces have a limited life. Periodic renewal causes continual attrition of a finite supply of historic setts
- > Curing periods for joints and laying course materials prolong the time to reopening a road to traffic
- > Cement staining of the historic setts can occur
- > Staged construction is more difficult than with flexible unbound construction. Construction joints make adequate compaction difficult to achieve and the exposed joint leads to variable curing of the bedding layer
- > Rigid surfaces are much more difficult to repair if they fail, or where they are opened up for works by public utilities
- > Water penetrating the surface can cause damage within the frost layer
- > Joints fulfil a different function in rigid construction and are visually wider, which detracts from the aesthetic quality and visual authenticity of the paving
- > Wide joints are often filled with tar. This material is not durable and pieces of litter which become embedded in the tar are unsightly and difficult to remove
- > Though interlocking is important to resist horizontal forces such as braking and turning of vehicles, the bonding pattern is often not executed with sufficient care to achieve this

Unbound flexible construction is the preferred method for laying historic setts from an architectural conservation viewpoint. It allows for ease of repair and, where necessary, recycling of material. It is therefore recommended that either historic setts are not used in severely loaded sites, or that a flexible system with an adequately designed sub-base is used as an alternative.



Failure of interlocking due to heavy traffic and lack of maintenance of joints causes unravelling of a surface



Cold tar jointing material on a salvaged sett is disfiguring and difficult to remove from the historic stonework

Re-laying setted pavements

Unfortunately, traditional laying techniques have largely fallen out of use and are often no longer properly understood by those involved in re-laying setts. Current practice is often to lay setts in a sand-cement mortar and, when historic material is reused, the setts are no longer sorted by size. Reused setts are often of a mixture of stone types and dates taken from different locations and, when not sorted, the considerable variance in the sizes of the setts gives rise to much wider joints, which alter the entire appearance of the paving. The visual quality of the result is far inferior, particularly when the wide joints are pointed

with sand-cement mortar or grouted with tar. When set in a sand-cement mortar the bonding pattern in such surfaces has no structural relevance as there is no contact between the setts. Without the discipline of structural necessity, the bond of offset joints is rarely followed with any rigour. The paved surfaces which result lack the authentic appeal of traditionally crafted surfaces.



Sett-laying in rigid construction without contact between setts. Note inconsistent joint width which is a result of the setts not having been sorted according to size.

Historically setts were laid on a sub-base of gravel, bedded in lime mortar, the narrow joints filled with fine sand, or pointed with lime mortar. With the advent of Portland cement, bound sub-bases were introduced.

From the mid-twentieth century, in areas where setts remained, the practice of filling joints with tar became prevalent, based on the belief that the partial vacuum caused by wider pneumatic tyres loosens the fill in joints and leads to displacement of the setts. Heavier vehicles have caused the breakdown of road sub-bases leading to undulation and damage to surfaces.

An examination of setted surfaces laid in the twentieth century in Dublin shows them to have been set in cold tar with a stone aggregate creating a flexible road surface, and grouted with hot tar. More recently setts have been bedded in a lean mix of sand-cement mortar and grouted with a high strength mortar. This rigid system can lead to cracking and crumbling of the bedding, causing localised displacement of setts. Tar grout is sometimes favoured in pedestrian areas as it creates a more even walking surface. However, the tar generally covers the edges of the setts, as setts are not always evenly laid, often pouring out across the surface. Technically tar grouting does not bond well to the sand-cement bedding mortar and the action of wheel tyres over time results in loss of the tar fill, which requires periodic touching up, further detracting from the aesthetic quality of historic paving.

Repairs in existing setted surfaces

Repairs are called for where individual setts have lifted causing a surface to begin to unravel; where subsidence has led to pooling of water; or where trenches have been dug to install or to access underground services. Even secondary laneways with little traffic should receive priority for repair works as these too make a significant contribution to the character of a city or town. In historic setted surfaces, the aim should be to disturb as little of the surface as possible. Minor undulations and unevenness should be accepted so long as the paving continues to function well and safely.



Unsuccessful repair using setts of different stone types, poorly set out and using inappropriate jointing material and methods

The aim of repairs in setted paving should be to retain its historic appearance. This can be achieved by respecting the existing laying pattern and, if the historic surface is homogenous, by using the same material – for example, diorite with diorite, granite with granite.

If the setts have been laid in sand only, small localised subsidence of up to approximately ten stones can be repaired by lifting the sunken stones with a tongs and washing in fine sand beneath until the surface can be brought back to level.

Larger areas of subsidence should be marked in chalk and rows lifted carefully, laid in ordered rows to the side and individual setts numbered if necessary. The sub-base should be renewed with suitable sharp graded sand to the correct level and compacted. The setts should be cleaned and returned to their original positions using a cord to ensure correct levels and alignment. The joints should be filled by pouring in fine sharp sand and the setts individually compacted using a heavy paving rammer of approximately 2.5 kilogrammes.

Jointing of setts

Joints are crucial to the structural integrity of a setted surface. Setts in a number of areas in Dublin retain unbound joints, although these have often lost some of the fill material and now appear as recessed joints. Partly open joints can result in the weakening of the surface over time, especially where there is vehicular traffic. These joints should be topped up with fine sand and compacted.



Setts poorly re-laid in sand-cement mortar with wide joints (above) giving the surface a very different appearance to an undisturbed historic surface (below) of tightly laid diorite setts

With the arrival of motorised traffic and pneumatic tyres, setts were often laid in cold tar with a sharp grit aggregate forming a flexible construction grouted with hot tar joint to create a more even surface and a durable joint. Since the 1990s the same hot-tar grouting has been used in combination with rigid construction consisting of a cement-bound base and sand-cement mortar joints and bedding. This has the following disadvantages:

- > Tar pointing does not bond to sand-cement mortar and lifts out over time leaving deep recessed joints. Spot repairs are sometimes made with sand-cement mortar causing an unsightly, patchy appearance

- > In rigid construction, joints are filled with sand-cement mortar and this can cause staining of the setts
- > Visually poor appearance as the edges of setts are usually covered and some setts become submerged entirely. If tar grouting is to be used, a high level of control and supervision is essential
- > Tar jointing carried out with pouring cans is a time-consuming and therefore expensive method, the results of which do not justify the expense

For reinstated setted surfaces, flexible construction with tight joints filled with fine sand is the preferred option from the points of view of conservation and visual appearance. The sand should be brushed into the joints and thoroughly compacted. Joints should be topped up in early life as the aggregate 'shakes down' and stiffens.



Untidy tar jointing allowing tar to run over the surface of setts



Cans for tar grouting

6. Metal Covers, Gratings and Street Furniture

Manhole and coalhole covers, gratings, bollards and other functional items are integral elements of historic ground surfaces. Often rare examples of their type, these small items give a particular insight into the past and are part of the country's civil engineering and industrial heritage.

The footpaths of many Georgian and Victorian streets are graced with a wealth of cast-iron coalhole covers in a wide variety of patterns, some having decorative geometric or foliate designs, others bearing the names of the foundries in which they were cast. They are an essential component of the domestic architectural heritage of that period.

Many other historic metal covers also survive in roadways. Among these are rare examples of round or oval metal covers with wooden inset panels; square manhole covers of robust construction, sometimes with patterned lids; and historic drainage gratings and vents.

Many properties have larger openings in the pavement, sometimes within private landings, which admit light to the basement, some of which are also capable of being used as delivery hatches. These are often made of cast iron with glass inserts and set in granite surrounds. The granite surrounds tend to survive where the rest of the historic paving has been removed because of their link with the panels.



Oval cover originally with timber inserts which have been inappropriately replaced with cement



Grating set in diorite paving



Pavement features such as pavement lights or cellar access hatches were provided with stone surrounds. Where only a remnant of the stonework survives, it should be an objective of any repaving works to replace the missing stones in order to re-establish the complete surround

Where historic bollards, wheel guards, and jostle stones survive, these are rare features which enrich the historic quality of the urban environment. Tram tracks which survive within setted pavements are evocative

features in areas with a strong industrial heritage, and these may also survive in covered setted surfaces in thoroughfares where trams formerly ran.



Cast iron bollard



Redundant tram tracks at the Guinness Brewery



Formed fireclay gutter stones



Stone bollards, or jostle stones, were used to protect buildings from damage from vehicles



Coalhole covers: Fitzwilliam Square, Dublin and Pery Square, Limerick. A meeting of the Dublin Paving Board in 1774 required that: 'all the stoppers of Coal Vaults, in the Foot Paths, or Carriageways, be made of cast metal not under one inch thick'

Coalhole covers and pavement lights

The coal chutes beneath the covers were used to deliver coal into the vaulted cellars below the footpaths. These were accessed from the open basement areas to the front of the typical townhouses of the Georgian era. The iron covers to these coal chutes were set in the centre of a paving slab and secured internally by a chain. In many cases, a small channel has been cut around the cover to help drain surface water away from the coalhole and it was quite common for coalhole covers to be removed in later years and the hole filled with concrete to keep water out of the cellars.

Coalholes and their covers, even when located on public footpaths, are not property of the local authority but of the building owner. As a result they were left in place during repaving works and the granite stones in which they are set are often the only elements of historic paving to survive on a street. These features are an important characteristic of a historic streetscape.

Any such item which needs to be taken up during works should be reset in its original position. Damaged items which are not capable of being replaced should be kept in storage with the owner's permission or returned to the owner.



Damaged granite flagstone surround to a coalhole cover. However, despite the damage it should be retained in situ with whatever minor repairs are required to mitigate further damage

Works involving metal covers and gratings

Historic gratings and covers in footpaths and roadways are rare features and every effort should be made to conserve them. The following points should be borne in mind:

- > The architectural conservation officer in the local authority should be consulted before any works are undertaken that would impact upon existing features
- > Damaged items should be repaired and retained in situ wherever feasible. In some cases, it may be considered acceptable to reuse repaired items in areas of lesser traffic
- > If removal is necessary for functional reasons or because of irreparable damage, salvage rather than disposal is essential
- > Manholes with timber inserts should have appropriate timber pieces refitted where the original inserts have been lost
- > Sometimes there may be only partial survival of the stones that originally framed the perimeter of a pavement basement light or cellar access hatch. Where repaving is proposed, the opportunity should be taken to restore the complete perimeter in stone in order to re-establish the meaning and coherence of the surviving elements
- > Where wide gratings pose a potential hazard to cyclists, wheelchair users, children's buggies and those using crutches, they can often be turned with the slots perpendicular to the direction of traffic rather than removed
- > An inventory of all stored items should be kept including details of the original location of the feature

Street furniture

The installation of new street furniture such as signposts, bicycle stands and pedestrian barriers should avoid areas of historic paving wherever possible. If it is not possible to avoid interference with the paving they should carefully detailed and set into historic areas of paving in a way which minimises damage to the paving and are, wherever possible, reversible, that is, they can be later removed with no damage having been caused to the historic features.

Holes to accommodate new items of street furniture should be drilled to avoid messy back-fill. Historic flagstones or kerbstones should not be drilled or cut with a grinder unless it can be proven that there is no alternative location for the new item. Where the installation of new bollards in historic paving is unavoidable, they should be set carefully and historic slabs trimmed or drilled to accommodate them, without sand-cement mortar backfill.



Good detail: a new flagstone is drilled to accommodate a signpost. Drilling a historic flagstone should be avoided in all but exceptional circumstances



Bad detail: modern slabs which were cut after laying and poorly backfilled resulting in some flagstones cracking and others cut with power tools

7. Historic Paving within the Public Realm

The public realm can be defined as all publicly owned and accessible areas such as roads, streets, lanes, parks and the like. Historic ground surfaces that are located within the public realm are not only of architectural heritage significance but are fully functioning pieces of public infrastructure that must be capable of meeting the needs of the modern city or town. On the other hand it should be recognised that a city does not serve a merely utilitarian need. A balance must be reached which allows the heritage of a city or town to coexist alongside its functional demands.

The role of the public authorities

Public authorities have a major role to play in the protection and conservation of historic ground surfaces and the features associated with them. However, there can be many different, and sometimes competing, roles that the authority has to play. For example, it may play the role of a planning authority: designating and protecting architectural heritage, or as a road authority: overseeing public utilities in opening-up works, traffic management, and the like. The authority may also contain an architects' department charged with designing improvements in the public realm. It is essential that the authority coordinates these various roles and responsibilities to ensure that any potential areas of conflict are identified at an early stage and an acceptable compromise is reached.

PROTECTING ARCHITECTURAL HERITAGE

The Planning and Development Acts are the primary legal basis for the protection of the architectural heritage. These Acts oblige planning authorities to identify, designate and protect all structures of architectural heritage interest in their functional area. This can include areas of historic paving, kerbstones and items of street furniture.

The architectural conservation officer is the local authority officer who is primarily charged with the implementation of Part IV of the Planning and Development Act covering the protection of architectural heritage. The architectural conservation

officer should be consulted by other departments of the local authority to advise on best conservation practice.

There are a number of steps a local authority can take to protect paving and associated features:

Recording and Mapping

The first step in the effective management and maintenance of historic paving is for the authority to compile an up-to-date data set of all significant surviving street surfaces and elements associated with them. This should include areas where it is known that historic paving survives beneath the current surface. It is important that the location of these areas be recorded to avoid inadvertent damage by road works, public utilities and other potential sources of damage.

Development Plan Policies

Policies can be included in development plans that recognise the importance of surviving historic paving, not merely as an attractive or decorative material but as a significant heritage asset. Intact areas of historic paving should be singled out for special attention, either as protected structures, as features within architectural conservation areas or by including specific development objectives for their protection. Particular attention should be paid to the conservation of rare undisturbed areas of paving.

Record of Protected Structures

The Record of Protected Structures (RPS) is included by each planning authority in its development plan which should include all structures of special interest in its functional area. Planning authorities should consider significant features such as old or well-preserved areas of paving, kerbstones, cobbled gutters and steps for addition to the RPS. Where any of these features are located within the curtilage of a protected structure, they are protected as part of that structure, even when not specifically listed in their own right.

All works that would materially affect the character of a protected structure or a proposed protected structure require planning permission or, where the works are proposed to public pavements, are subject to the requirements of Part 8 of the Planning and Development Regulations.



An area of historic paving can be protected by being within the curtilage of a protected structure or can be a protected structure in its own right

Architectural Conservation Areas

Architectural Conservation Areas (ACAs) are designated by a local authority to protect important groupings of structures including the open spaces between them. Street surfaces generally lie within the public realm and works are not subject to normal planning control. However, such works may require to be submitted to a process under Part 8 of the Planning and Development Regulations.

Roads authorities, and others carrying out works, should notify the architectural conservation officer in the local authority of proposed works in the public realm within an ACA that would impact upon historic ground surfaces or upon the character of the area or on any protected structure. This includes openings by statutory undertakers for repair or renewal of underground services or routine maintenance and repair works to roadways and footpaths. It is generally of advantage to all concerned to resolve any major issues at an early stage in the design process.

Public Realm Strategies

An authority may consider devising and adopting a public realm strategy which encompasses its policies and objectives for the public realm, including protection and conservation of historic street surfaces and elements. A public realm strategy can be used to address issues including, among others:

- > Controlling and enhancing transport and vehicular movement through the city or town
- > Enhancing a pedestrian's and cyclist's journey through the public realm
- > Strategies for controlling the amount of signage, advertising and other new interventions
- > Strategies for decluttering public streets of redundant or unnecessary elements
- > Programmes for the repair and reinstatement of historic paving, including concealed surfaces
- > Setting out the quality of workmanship and materials to be used in works impacting on historic features
- > Setting out the quality of design and specification of new works and new interventions into the public realm
- > The maintenance and care of the public realm, including the training of staff to carry out routine works
- > Strategies for controlling works by public utilities

Planning control

Where development is proposed, a planning authority may impose conditions on grants of planning permission in streets where historic paving, kerbs or setts survive, and where the carrying out of the development may affect the character of an adjacent pavement.

Where planning permission is granted for modifications to footpaths to allow vehicular access, known as 'dishings', conditions may be attached to protect adjacent paving from avoidable damage. Applicants for planning permission for dishings, or for developments adjacent to historic areas of paving, should be asked to provide a methodology

for the protection of the pavement or the paving material. Proposals of this type should be referred to the architectural conservation officer for advice. If permission is to be granted, planning conditions could require:

- > Submission of measured survey drawings and photographs prior to commencement, recording all historic surfaces and integral elements adjacent to or within a proposed development
- > Measures to protect historic surfaces from damage during the construction period, including protection of pavement sub-bases from overloading by construction vehicles, delivery vehicles and general traffic
- > Conditions for the careful lifting, numbering, cleaning, stacking and storage of historic elements in the exceptional cases where lifting of historic pavements is considered acceptable. Lifting of historic pavements should not be permitted where it is not necessary for its protection or where it can be avoided. The storage location and an inventory of the items stored should be submitted once lifting has taken place to verify that it is returned intact
- > Re-laying of paving on completion of the works to follow the guidance contained in this booklet
- > Measures to be put in place to protect historic surfaces from damage after construction has been completed, for example, to prevent parking of vehicles on the surfaces

ROADS AND TRAFFIC DEPARTMENTS

The care of street surfaces is vested in the roads and traffic department of the relevant local authority, or in the National Roads Authority (NRA). The powers of these authorities derive from the Roads Acts. Roads and traffic departments in larger authorities are divided into several areas, each of which may have a role to play in the protection and conservation of historic surfaces.

Maintenance

Roads departments of local authorities are responsible for routine repairs, including the renewal of surfaces where no significant changes to layout or design are to be made. This competence includes control over the opening and closing of surfaces by statutory undertakers in charge of underground utilities and the creation, subject to planning permission, of dishings for private vehicular entrances and at crossings to improve accessibility for the vision and/or mobility impaired. Although maintenance and repair work may be at a micro-scale, consultation with the architectural conservation officer is important as much damage can be caused to historic ground surface by even apparently minor works.

Design

Roads and traffic departments are responsible for the detailed design of large-scale improvements to the public realm involving alterations to pavements such as widening of footpaths and upgrading of surfaces with new paving. Detailed design work is sometimes based on initial designs by the architects' department or by external landscape design firms. Where historic elements may be affected by a proposal, consultation should be carried out with the architectural conservation officer from the earliest stage of the design work.

Construction

Roads and traffic departments are responsible for construction of improvement works or, where the works are contracted out, for tendering the work to external contractors and overseeing the construction work. Projects for improvements in the public realm generally have larger budgets at their disposal than repair works and this opportunity should be used to ensure protection and integration rather than removal of historic street surfaces.

Planning

Roads and traffic departments are generally consulted in all planning applications and issue a roads report. This power could be used as an opportunity to recommend conditions for the protection of historic paving, as referred to above.

Other sections of roads and traffic departments which may influence the future of historic street surfaces include traffic control, public lighting, road safety, streets and infrastructure, roads administration and parking enforcement.

LOCAL AUTHORITY ARCHITECTS

Architects' departments in local authorities are responsible for conceptual design in many improvements to the public realm, including the creation of new civic spaces, sometimes in conjunction with external architects or landscape architects, or in initiating design competitions. Some local authorities employ specialist conservation architects within their architectural departments who can also provide advice on protection of historic paving.

Underground utilities

The intervention with the greatest potential to damage historic pavements is the laying or repair of underground utilities. The maintenance and repair of public roads are carried out either by the road authority or by a body acting with its consent. In addition, a number of statutory and licensed undertakers have the right to open, dig or excavate a public road to provide, improve and maintain essential services located underground. These utility services include electricity supply, telecommunications, natural gas, water services, wastewater and drainage services, and public lighting. All statutory and licensed undertakers have a legal obligation either to consult with, or get the approval of, the road authority before undertaking works to public roads. It is important that the authority puts in place procedures to ensure that the relevant departments and officers within the authority, such as the architectural conservation officer, are consulted before works are approved. It is generally recommended to appoint an architect with conservation expertise and experience to guide works by utility services that would affect historic ground surfaces. It is further recommended that skilled masons be part of the construction team carrying out the works.



Extensive damage to a setted pavement caused by laying of underground services



A series of uncoordinated works have taken place to this section of paving in a historic area resulting in the localised loss of the original paving and some kerbstones and an unsatisfactory patchwork of different materials. In addition, the position of the large metal cover at the corner has made it impossible to reinstate all of the granite kerbstones

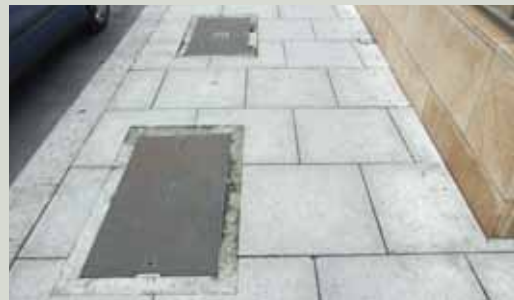
Through powers made available to local authorities under the Roads Acts, the road authority bears responsibility for both the function and structure of a road and regulates all works to the public road or pavement made by statutory or licensed undertakers who wish to open a road surface for laying of services. The road authority may place such restrictions and conditions as it thinks fit, however its powers are circumscribed by the various Acts and regulations which govern the activity of each individual utility company.

The Department of the Environment and Local Government publication *Guidelines for the Opening, Backfilling and Reinstatement of Public Roads* (2002 and under review at the time of writing), sometimes known as the 'Purple Book', sets out the legal, administrative and engineering procedures in opening or forming trenches in public roads in Ireland. Specific reference to historic surfaces is not made in the publication, as that is not the focus of that document. However, with some minor modifications and additions, the procedures can be adapted to ensure the proper protection of historic paving. Where historic street surfaces would be affected by road-opening works, the following steps are recommended:

- > The application for a road opening licence should include details of the location and extent of the area to be opened up together with a detailed photographic survey, supported by drawings and sketches as necessary
- > The architectural conservation officer or conservation advisor should be given the opportunity to attend the initial inspection of the site to assess the licence application
- > The road opening license should include conditions for the lifting, cleaning, storage, protection and reinstatement of any disturbed elements of historic paving, including the use of suitably skilled craftworkers and adherence to guidance contained in this document
- > If reinstatement can proceed immediately, materials should be stored on site otherwise arrangements should be made for safe storage off-site (see Chapter 3)
- > The architectural conservation officer or conservation advisor should attend joint inspections of the road authority and the licensee, where appropriate
- > Any further conservation requirements for reinstatement as may result from the works should be stipulated in the permission for final reinstatement (e.g. repair of damage to adjacent paving, integration of new access covers, etc.)
- > The architectural conservation officer or the conservation advisor should be satisfied with the standard of the completed works before the release certificate is issued

The following aspects should be considered in assessing a licence application:

- > In the case of intact historic paving, the applicant should be required to demonstrate that an alternative route for trenches is not possible
- > Trenches should be kept as narrow as possible to minimise disturbance and to allow good compacting of backfill



In this example of new paving, an effort has been made to ensure that the access covers are aligned parallel to the kerbstones, but with an unsightly wide border of mortar which is deteriorating



Temporary surface in a granite flagged footpath. Unfortunately it appears that several historic flags were removed or cut in the process of this installation and there has been no attempt made to design a cover appropriate to the historic location



The granite kerb has been cut through and partially lost rather than locating the new installation within the area of modern paving

Access points to underground services

Access points to underground services are unavoidable functional requirements in a modern city or town. Wherever possible, underground services should not be placed in areas of surviving historic paving as this will inevitably require repeated re-lifting of the surface and the insertion of access points. Where services have previously been installed beneath historic surfaces and new access points are required, great care should be taken to insert these in a way which does not damage the appearance of a pavement. Where the laying of underground services beneath historic paving is unavoidable, the following points should be observed:

- > Underground services should be designed to allow for the most unobtrusive location of covers possible and to minimise the required number of access points
- > In particular, access points serving traffic lights require careful design as they may clash with dished surfaces and tactile slabs resulting in unsightly areas of paving at pedestrian crossings
- > The size of access covers should be kept to an absolute minimum. Their location requires careful consideration and should be planned in advance of works to avoid ad-hoc placement. They should be located to avoid damage to specially shaped stones such as radial stones at street corners and should be parallel to geometry of paving. This will require advance planning as paving may not be in place when chambers beneath the covers are constructed
- > Any new covers should be of high quality design and materials in keeping with the quality of the historic environment. The use of standard solutions is unlikely to be appropriate in areas of architectural heritage significance. Well-designed and durable metal covers that do not require regular replacement are recommended within a historic setting
- > The junction of paving to access covers should be a narrow joint as is now used in high-specification upgrading works using new stone paving. Wide sand-cement mortar surrounds, which allow covers to be 'broken out' in future maintenance works, are to be avoided as they seriously detract from the appearance and quality of a historic pavement.
- > Frames for covers should be deep enough to allow for the laying of paving with a tight joint



Access covers installed along a highly significant Georgian street have created a patchwork of different materials and flagstone sizes which disrupt the appearance of the Neo-classical street



Access points set in concrete within a granite pavement in a manner not appropriate to the high-quality historic environment

Maintenance of historic pavements

The correct maintenance of historic street surfaces is crucial to their conservation and survival. The conservation principles that apply, and the skills that are required, for the repair and renewal of historic surfaces also apply to maintenance work and minor repairs.

Good maintenance includes all work which prevents the deterioration of a historic surface. This involves preventing damage and intervening quickly when a problem arises to limit the damage, and thereby save money in the long term. Necessary maintenance works include the re-bedding of loose, cracked or rocking flagstones, re-bedding of dislodged kerbstones, topping up of sand joints and the repair of loose pointing.

Directing more resources towards the maintenance of historic surfaces can prolong the life of a valuable heritage resource and minimise the need for major repair works. Insufficient maintenance can be a serious issue in the conservation of historic paving. It can often lead to a preference for so-called 'maintenance-free' solutions, such as the application of hard pointing materials which, although perceived as being more durable, may in fact accelerate decay of the stone. Lack of maintenance may also result in surfaces in need of repair being allowed to deteriorate to the degree that replacement is required.

Street cleaning

Pressures to reduce labour costs and requirements by business groups for enhanced cleaning regimes have led to the increased use of mechanised methods of street cleaning. Sweeping of pavements is now widely carried out with mechanical sweepers, generally fitted with contra-rotating brushes in the front which catch the litter and direct it to a central suction nozzle where it is sucked in and pulverised. However, where there is a historic ground surface, mechanised cleaning methods can adversely affect both the jointing and bedding materials and leave scour marks on the surface of the pavement. The weight of large ride-on machines can cause cracking of flagstones. They create additional problems when they move from the roadway onto the footpath, by bringing with them contaminants such as oil residue which is then deposited on the surface of the stone. Manual sweeping continues to be required in certain less accessible areas.

Where historic street surfaces survive, cleaning equipment and methods should be chosen which do not overload or damage the historic material. Where jointing is unbound it should first be verified that any mechanical sweepers used do not suck or otherwise remove material from compacted joints. Even where cement pointing has been used, examples exist where this too has been removed from the joints by cleaning equipment.

Power washing may not be appropriate in areas of historic paving, particularly those with open or unbound joints where it would wash out the jointing material. Power washing can also saturate the stone and so promote decay, not only in the paving but in the adjacent walls of buildings. It may also promote the growth of algae and plants in the joints between the flagstones or setts or in the joint between the paving and the building.



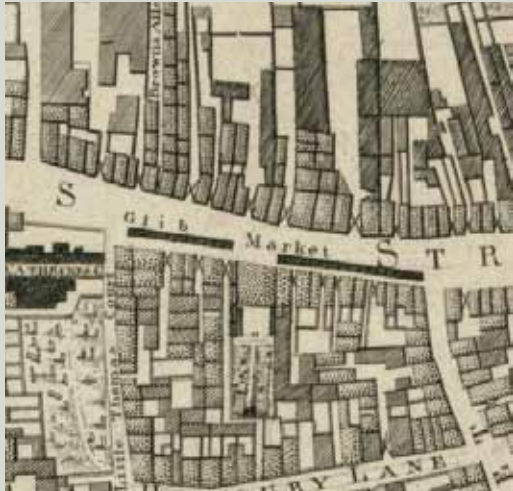
Damage from mechanical cleaning equipment can be seen on this concrete pavement

Decluttering historic streets

While no doubt considered necessary at the time of installation, many items of street furniture are no longer required, are duplicated or redundant. In historic areas, not only have many of these become unsightly but they can create obstacles and potential litter traps. A local authority should carry out an inventory of existing street furniture in historic areas. The retention of each piece of equipment should be justified or if this is not possible, it should be removed. Where elements of street furniture are of historic or social interest such as water fountains, place-name plaques, jostle stones and the like, these should be left in place and protected even when redundant.

The opportunity may also be available to relocate or merge functions for example, to mount multiple signs on existing poles, private boundary walls or on buildings if appropriate.

8. New Interventions in the Public Realm



In Thomas Street, Dublin, the organic form of the street accommodated a market of medieval origin, called the Glib Market, that was arranged parallel to the buildings fronting the historic route. The Glib Market was recorded by mapmaker John Rocque in his map of Dublin, 1756. The location of the most prestigious townhouse was emphasised by the arrangement of the market to either side of its façade allowing it to have a prominence within the overall streetscape similar to Saint Catherine's Church further along the street. Such features require careful research and analysis so that new interventions into the public realm respect historic settings in terms of the quality of design, the scope of the intervention and have due regard to the conservation of original route alignments and focal points

As with any other urban area, a historic area continues to evolve and many streetscapes comprise multiple layers or building periods. The origins and significance of a place should be understood as a preliminary step to planning alterations or making decisions as to its future management, so that the original design intent or logic is not lost when new works are undertaken.

Good design should be part of normal working practice. In many cases, a multi-disciplinary approach to alterations is needed. Good quality, durable materials should be used and there should be a respect for local materials and authentic traditional detailing. High standards of workmanship are required in conserving and repairing historic paving and also in setting out, reworking and laying new paving. When it is proposed

to introduce new elements into the streetscape, such as light fittings, signage, bollards, seating and the like, the need for these should be strongly justified to avoid unnecessary clutter and introducing hazards for users. The proposed locations should be carefully considered in terms of the logic of the original space, its buildings and its key focal points.

Understanding the site

The starting point in planning new interventions into the public realm should be to gain an understanding of the historic development of the particular location. New schemes provide an opportunity to reinforce a connection to the past and to thereby strengthen the character of an area.

Historic maps, town plans, topographical views and early photographs should be consulted and analysed to generate a proper awareness of the historical form. New interventions should be informed by the history of the site, even in cases where modern circumstances preclude reinstatement of earlier paving or other features of the public realm.

Widening or reconfiguring footpaths

Widening or other reconfiguring of footpaths should respect the historic original layout where possible. The following principles should apply:

- > Avoid lifting or disturbing historic paving, particularly areas that have never previously been disturbed
- > Avoid re-laying historic material in modern layouts
- > Avoid creating new routes or configurations that would remove surviving historic elements or features or leave them in incongruous new settings
- > Retain historic kerbstones. Where these are not continuous, consolidation into one part of a street may be acceptable following agreement with the architectural conservation officer

- > Ensure that, where required, the widening of a footpath is a contemporary addition in sympathy with the historic one, conserving its key characteristics including existing falls and drainage arrangements
- > Where strong, cement-based materials are used to point or bed new work this should not be allowed to come in contact with historic paving stones



Historic flagstones and kerbs re-laid in an incongruous modern layout



A widened pavement has left the original flags in situ while constructing the new section in a compatible material. The final appearance would have been improved if the sizes and pattern of the new and old flags also matched and the joint between old and new was tighter and filled with a more appropriate pointing material

Sometimes historic kerbstones are not consistently wide where they extend into the bond pattern of a flagged footpath or form the edge of a randomly cobbled path. In such cases, the historic kerbstones should never be cut to create a straight junction to new paving; the new paving should be adjusted and laid to follow any irregularity in the historic material.

New granite paving often has a sawn finish which easily gathers dirt, obscuring the natural beauty of the stone, and can come to resemble concrete paving in appearance. It can take generations of wear to eventually expose the grain of this material. It is recommended that careful specification and quality control be carried out to ensure a texture which enhances the streetscape, particularly where this is used in historic settings, or in conjunction with historic pavements.

Careful consideration should be given to the specification of new materials. For example the use of small paving units in historic areas can lead to a tiled effect and an unsatisfactory appearance which distracts from the architectural heritage of the area. The colour of new materials should also be appropriate to its setting. Materials such as red engineering brick or coloured concrete slabs are rarely appropriate in an Irish city or town where, traditionally, the easy availability of good quality granite or limestone makes grey the most appropriate colour for the ground surface in a historic setting.



Good workmanship and detailing: new paving has been cut accurately around cover creating a tight joint and the cover has been placed parallel to paving joints



Poor workmanship and detailing: A wide border around the new insert has been backfilled with sand-cement mortar

New street furniture

Where new elements are proposed to be installed in a historic area, careful consideration should be given as to whether or not they are in fact required or whether, in the interests of avoiding clutter, they could be omitted or combined with existing elements. New items, such as traffic signs, bins, bollards, guard rails, electricity mini-pillars and other street furniture, should only be placed in a historic street if there is an exceptional public need for it and should avoid disturbing or damaging elements such as paving or railings. The location and placement of all new items should be carefully chosen to avoid adverse impact on the historic built environment.

Utilitarian items such as traffic light control boxes or electricity supply mini-pillars can be particularly intrusive in an historic environment. These should be considered carefully at design stage in consultation with the architectural conservation officer, and either replaced with alternative solutions, or minimised in number and placed judiciously where they do not interfere with historic buildings, shopfronts, paving, railings, and the like. Similarly, placing these elements at vacant sites should be avoided where they might compromise the future development of the site.

Integration of trees

The character of an area or street should be taken into account when assessing the need for new tree planting. The planting of trees and shrubs may not always be appropriate to a particular location; for example, while trees may form an essential part in the design of an Arts-and-Crafts period suburban road, formal Neo-classical streets were rarely intended to contain trees except within planned gardens or squares. Where trees are to be introduced, the species selected should take account of the setting, and the height and girth of the fully mature tree should be planned for.

Difficulties may arise where street trees are poorly integrated into historic paving. Commonly, trees were planted close to the kerb and no provision was made for the girth of the trunk to grow, resulting in lifting and displacement of kerbs and paving slabs around mature trees. The following should be taken into account when considering planting trees in proximity to historic paving:

- > It should first be ascertained that there are no historic basements or cellars located beneath the surface
- > The planting of new trees should not require interference with, or disturbance of, historic paving or kerbs
- > A generous unpaved area of earth or gravel should be created around the tree trunk to allow for the growth of the trunk and to allow adequate water to penetrate to the root system
- > Where paving is randomly bonded, this unpaved area around the tree trunk can also be random in shape to suit the paving system and avoid the cutting of historic slabs
- > New paving work adjacent to existing trees should be executed with great care to avoid damage to tree roots. Roots should on no account be cut
- > Where necessary, guards of good quality design and materials and of appropriate size may be put in place to protect trees from being vandalised or hit by vehicles



A lack of provision for the growth of the tree has led to damage and displacement of kerbstones and flags



A solution in a new pavement for the treatment of a mature tree

Providing accessible routes

The public realm should be accessible to all citizens and this may provide particular challenges where historic surfaces survive. There may also be a need to provide access routes through privately owned sites with historic ground surfaces. The making of accessible routes needs to pay due consideration to surviving historic fabric and its significance. Proposals to create accessible routes through historic ground surfaces should be preceded by a detailed survey and analysis of the area to ensure that the historic character of a surviving surface or space is retained. The maintenance of accessible routes is critical as even small dips or potholes can be hazardous for those with vision impairment or for wheelchair users. For further information see *Access: improving the accessibility of historic buildings and places* in this Advice Series from which much of the guidance in this section is drawn.

WHEELCHAIR ACCESS

Historically, streets were designed to have footpaths raised above the roadways for practical reasons including to protect pedestrians from vehicular traffic. However, this feature gives rise to changes of level at every street crossing, sometimes consisting of more than one step which will form a barrier for wheelchair users.

The dishing of pavements at crossings can cause damage to the visual quality of historic pavements where there is a requirement to cut flags to achieve a dished surface over a short distance. Where original material is adapted and reused the visual quality of the intervention is more easily preserved. The most successful solutions are where the gradient is extended over a longer distance to allow a slope to be formed without cutting flagstones and retaining the original laying pattern. Where granite pavements need to be entirely re-laid, this approach should be followed.

Many surfaces are uneven and difficult for those with mobility impairment to use. At street crossings or on routes over setted or cobbled areas, flagstones can be laid in the manner of smooth wheel tracks, which were traditionally provided at street crossings.



Where possible, the alteration of rare decorative radial corners should be avoided so that the especially-cut stones are not damaged or lost. In this case, the flagstone pattern has been successfully re-laid to create a dishing using the original flags and kerbs



Dishing created using the original material with some cut slabs. However, the location of the pole and the parking of a motorcycle on the pavement create hazards for users with vision or mobility impairment



Paving bricks make the creation of dishing easier, but are out of character with the historic area and the setting of the buildings and have resulted in the loss of a large area of flagged paving

ACCESS FOR USERS WITH VISION IMPAIRMENT

New tactile paving within a historic setting should be well-designed to coordinate with the surrounding streetscape. The colour of the tactile paving should harmonise with adjoining historic materials whilst providing sufficient tonal contrast for people with vision impairment. New tactile guidance and hazard paving can be formed in stone or other appropriate material either cut or cast to the correct profiles with slip-resistant metal studs or bars; applied or inserted. Selecting the appropriate type of tactile paving can be complex bearing in mind that different profiles are used to signal different conditions, for example at road crossings, at traffic lights (signalled crossings), at un-signalled crossings, to provide hazard warning at external changes in level, and to provide directional guidance when negotiating wide open spaces. Incorrect and inconsistent use of tactile surfaces is a danger to people with low vision or hearing impairments as well as to blind people. It gives people the wrong clues which defeats the objective of using tactile surfaces. It is important therefore, that those responsible for managing external environments follow approved standards and take professional advice.

The method chosen for installing tactile paving is dependent on the nature of the location where it is to be installed. Mechanical fixing of studs and bars is usually the most reliable but there are situations where this is not appropriate, particularly where irreversible damage would be caused to historic paving, and alternative methods and materials should be explored. The cutting of the surface of historic paving or steps to create a tactile surface is not recommended as this causes irreparable damage to the stonework. Resin-bonded tactile profiles are available which can be applied to the historic surface. They should only be used in cases where they would not damage the historic finish, would be readily reversible and would not wear in such a way as to create a hazard. Where the existing paving surface is rare or a unique surviving example of its type, it should not be altered.

Other potential issues which may arise include:

- > The use of standard red and yellow concrete blistered paving slabs will usually be inappropriate in areas where historic paving exists. The contrasting colour is generally red, which is a colour not traditionally seen in ground surfaces in Ireland
- > Vision-impaired users require a contrasting colour and alternative colours such as the dark grey found in diorite setts may often provide sufficient contrast
- > The areas often have a border of black paving bricks which is used for stylistic rather than functional reasons. Tactile areas without such a border would harmonise better with the simplicity of historic pavements
- > Tactile paving slabs should follow the geometry of the host pavement and, where fitting in to irregular arrangements is necessary, it should be the tactile material which is cut rather than the historic flagstones. Careful control and supervision of such work is crucial to allow informed detail decisions to be reached



Tactile paving needs to provide a visual contrast but should follow the pattern and geometry of the existing paving



The unnecessary use of too many materials is unsightly, as is the ad-hoc placement of access covers

- > Stainless steel studs are often used to provide an aesthetically superior tactile surface. However, these have not found acceptance with all vision-impaired users as the highly reflective finish of the studs causes glare which further compromises the sight of those with partial sight. Brass studs of duller finish may provide a workable alternative. In conjunction with historic paving, studs are a better solution as they can be "retrofitted" to existing surfaces. At crossings where a colour contrast is needed other solutions are required

- > At street corners, the extension of the tactile surface across the footpath regularly contributes to jarring clashes with adjoining tactile strips, dished surfaces, covers serving traffic lights, and the like. Such confused solutions are visually very damaging in the context of historic pavements

The National Council for the Blind of Ireland (NCBI) provides guidance on the needs of vision-impaired users and also guidance for architects and engineers planning the external environment (see Further Reading below).



In some continental European cities, a system of guide strips is used to lead from crossing to crossing, which obviates the need for a tactile band across the footpath. In this example in Copenhagen, guide strips of elongated brass studs were retrofitted into modern paving

Vehicular traffic

In the past, road design in urban areas often placed a disproportionate emphasis on the through movement of vehicular traffic. The result was significant adverse impacts on historic city and town centres of widened roadways, increased levels of road markings, signage, and traffic lights. In many cases, this was to the detriment of pavements, kerbstones and other elements of the historic street. The modern approach to designing and managing streets seeks to reintegrate the needs of all the different users of a street including vehicle drivers, cyclists and pedestrians. This can create greater scope for the conservation of historic elements and the reincorporation of traditional street details and materials in new designs. However, success is dependent on the use of high-quality design, materials and workmanship in keeping with the character of the historic area.

TRAFFIC MANAGEMENT

Traffic calming measures should be appropriate to the character of the historic area and should be designed to respond to the unique place. Standardised solutions will rarely be appropriate. Local materials should be used wherever possible to reinforce the sense of place. Existing features should be used and incorporated into the design of traffic calming measures. Setted pavements are known to be effective in calming traffic. Traditional paving design often incorporated crossing strips for pedestrians in alternative materials and this type of feature could be reincorporated to provide a type of rumble strip at the entrance to a street.

Wherever possible in a historic area, road markings and signage should be kept to a minimum to avoid adverse visual impacts. The painting of lines and other road markings on historic paving should be confined to those essential to road safety.

PARKING

Parking of vehicles such as cars and delivery vans on historic ground surfaces, including footpaths, pavements and private landings, not only detracts from the visual quality of the built environment, but can cause irreparable damage to historic flagstones and kerbs. It can also cause serious accessibility problems for those with mobility or vision impairment. In areas of historic paving, it is recommended that a strict management system be introduced to prevent vehicular parking on historic flagstones and on kerbs, even where strong foundations have been provided.

Bollards are often installed to prevent vehicles mounting the footpath and can be important in ensuring that historic paving is not damaged. Ideally bollards should not be set into historic paving. A properly enforced parking system should do away with the need for bollards which cause disruption and damage to historic surfaces and can be visually unattractive. This applies equally to areas of paving in the public realm and on privately owned and managed properties.

In historic areas of a city or town, on-street car parking and its associated elements, such as parking meters, road markings and the like, can have a negative visual impact, even when cars are absent in the evenings or at weekends. This impact can be mitigated or even eliminated if setted surfaces are reinstated and parking bays delineated in a visually discreet manner, for example with metal studs.



Parking on private landings can be unsightly and hazardous to other users



A historic surface has been damaged by poor workmanship in erecting bollards to prevent parking and in laying underground utilities, leading to unnecessary loss and damage of setts

VEHICULAR ACCESS

Restrictions on access for heavy vehicles may be necessary in areas where streets are too narrow to allow large or long vehicles to turn street corners within the confines of the existing roadway.

Vehicular access drives which are subject to greater loading are often constructed in modern materials across areas of granite footpaths and, if not carefully designed, can detract from the integrity and visual quality of historic paving. In addition they often have a negative impact on the setting of important protected buildings. The protection of historic pavements should be a consideration in proposals for such vehicular access points. If deemed justifiable, a structural solution should be required of the applicant which would allow matching new stone to be used with a sub-base of load-bearing design.



Modern brick panels inserted into historic paving help to avoid damage and cracking of granite flagstones by heavy vehicles driving over. However, the use of modern engineering brick is visually unsatisfactory

Where only lighter loads need to be provided for, a suitably tested solution which would allow retention of the historic paving slabs and guarantee their protection from damage should be preferred.

Buses are heavy vehicles and can cause damage to historic surfaces that are not designed to sustain these loads. In particular, kerbs at bus stops are commonly affected. Safety issues have led to the installation of raised tactile kerbstones at major bus stops. Although necessary to ensure passenger safety, the installation of such kerbs should take account of the historic urban context in which they are located. The positioning of bus stops should be undertaken in consultation with the planning authority and architectural conservation officer, particularly where raising and replacement of historic pavements and kerbs is involved.

Further Reading

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Useful Contacts

If the historic paving is protected, or is located within the curtilage of a building which is a protected structure or within an architectural conservation area, the architectural conservation officer in the local authority should be the first person to contact with queries regarding works to it. Other useful contacts include:

Department of Arts, Heritage and the Gaeltacht,
Architectural Heritage Advisory Unit,
Custom House, Dublin 1
Telephone: 01 888 2000
Web: www.ahg.gov.ie

Department of Communications, Energy and Natural Resources,
Geological Survey of Ireland, Beggars Bush, Haddington Road, Dublin 4
Telephone: 01 678 2000
Web: www.gsi.ie

Engineers Ireland, 22 Clyde Road, Ballsbridge, Dublin 4
Telephone: 01 665 1300
Web: www.iei.ie

Heritage Council, Áras na hOidhreachta, Church Lane, Kilkenny
Telephone: 056 777 0777
Web: www.heritagecouncil.ie

Irish Architectural Archive, 45 Merrion Square, Dublin 2
Telephone: 01 663 3040
Web: www.iarc.ie

Irish Georgian Society, City Assembly House, 58 William Street South, Dublin 2
Telephone: (01) 679 8675
Web: www.igs.ie

Royal Institute of the Architects of Ireland, 8 Merrion Square, Dublin 2
Telephone: 01 676 1703
Web: www.riai.ie

Society of Chartered Surveyors Ireland, 38 Merrion Square, Dublin 2
Telephone: (01) 644 5500
Web: www.scsi.ie

Glossary

ANDESITE

A fine grained, grey or tan igneous rock

ARRIS

A sharp edge at an external angle produced by the meeting of two surfaces such as the edge of a cut stone

ASPHALT

A mixture of bituminous pitch with sand or gravel

BASALT

A black or dark fine-grained igneous rock

CEMENT

A binding material mixed with aggregate and water to form a mortar or concrete. The term is usually taken to mean an artificial cement such as Ordinary Portland Cement

CLAST

A fragment of a rock which is composed of pieces of older or pre-existing rocks

COBBLE

A small round, or ovoid, stone found on beaches or in river beds

DIORITE

A coarse-grained, dark igneous rock

DOLERITE

A medium grained, dark igneous rock

FLAG / FLAGSTONE

A square or rectangular stone or concrete paving slab

JOINT

The mortar between two stones

JOSTLE STONES

Usually cylindrical stones set adjacent to the corners of buildings or gateways to protect from damage by the wheels of passing vehicles. Also known as wheel guards

LIME, HYDRAULIC

Hydraulic limes contain a percentage of clay which produces a pozzolanic effect in mortars, that is, the mortars set chemically assisted by the presence of water. Hydraulic limes can occur naturally, or can be artificially made

LIME MORTAR

A mortar made from lime, aggregate and water that, on exposure to air, carbonises and hardens

LIME, NON-HYDRAULIC

Non-hydraulic lime is pure, or almost pure, lime. Mortars made of non-hydraulic limes can only set through contact with air, a process known as carbonation

LIME PUTTY

A soft putty made from slaking quicklime in water. Used as a binder in most traditional mortars and renders prior to the invention of Portland cement

MORTAR

The mixture of a binder (such as lime or cement), aggregate and water to form a substance used to bind bricks or stones

POINTING

The application of a separate facing mortar applied onto the bedding mortar

RIBBON OR STRAP POINTING

Pointing which is not flush with the building surface but stands proud

SETTS

Small cut blocks of stone used for paving

TOGHER

From the Irish word 'tóchar', a roadway or causeway constructed from brushwood, timber or stone. These can date from pre-historic times to the late-medieval period

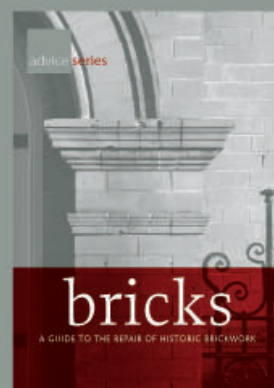
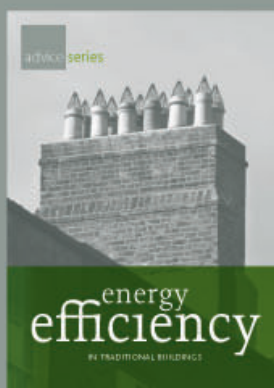
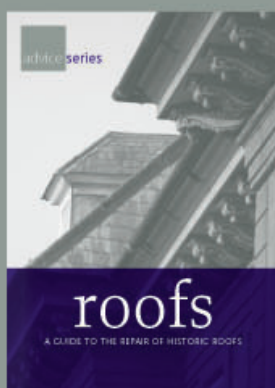
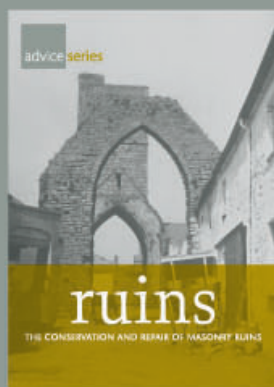
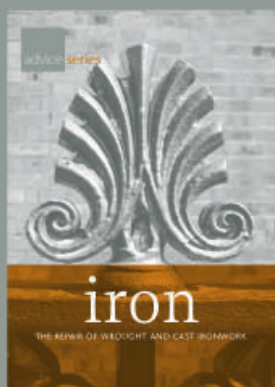
WHEEL GUARDS

See 'jostle stones'

WHINSTONE

A general term for any finely grained igneous rock usually dark grey, green or black

The Advice Series is a series of illustrated booklets published by the Architectural Heritage Advisory Unit of the Department of Arts, Heritage and the Gaeltacht. The booklets are designed to guide those responsible for historic structures on how best to repair and maintain their properties.



This guide gives advice to those responsible for the care and conservation of historic ground surfaces including:

- Understanding the significance of historic pavements
- Recognising when there are problems
- Planning repairs to historic paving
- Making decisions about historic paving within the public realm



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