Historic England

Essex

Building Stones of England

The Building Stones of England

England's rich architectural heritage owes much to the great variety of stones used in buildings and other structures. The building stones commonly reflect the local geology, imparting local distinctiveness to historic towns, villages and rural landscapes.

Historic England and the British Geological Survey (BGS), working with local geologists and historic buildings experts, have compiled the Building Stones Database for England to identify important building stones, where they came from and potential alternative sources for repairs and new construction.

Drawing on this research, plus BGS publications and fieldwork, guides like this one have been produced for each English county. The guides are aimed at mineral planners, building conservation advisers, architects and surveyors, and those assessing townscapes and countryside character. The guides will also be of interest if you want to find out more about local buildings, natural history, and landscapes.

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First published by Historic England in October 2020. This edition published by Historic England May 2023.

Front cover: Chelmsford Cathedral. Building stones include Sarsen stone, split quartzite, Quaternary Flint and Quarry Flint. © Trevor Benbrook / Alamy Stock Photo.

Please refer to this guide as:
Historic England 2023 *Essex. Building Stones of England*. Swindon. Historic England.

HistoricEngland.org.uk/advice/technical-advice/

How to Use this Guide

Each guide describes the local building stones in their geological timescale order, starting with the oldest layers through to the youngest. The guide ends with examples of other notable building stones from other parts of England and further afield.

Geological time periods, groups, formations and building stones

Each building stone is listed under the relevant geological timescale, group and formation. A formation may be divided into members and where relevant these are referenced in individual building stone sections.

Middle Jurassic
↑— geological time period
Inferior Oolite Group, Lincolnshire Limestone Formation
↑— geological group ↑— geological formation
Lincolnshire Limestone
↑— building stone (alternative or local name)

Bedrock geology map and stratigraphic table

To help you with the geology of the area, there is a bedrock geology map and a stratigraphic table which shows the layers of rocks and the associated building stones in this geological timescale, group, formation order.

Page numbers for each building stone are included in the stratigraphic table for ease of reference. The page numbers are inverted to correspond with the geological age order.

Contents list

If you click on the page number for a building stone in the Contents list, you will go straight to the relevant section in the guide.

Building stone sources and building examples

A companion spreadsheet to this guide provides:

- More examples of buildings. Information is included on building type, date, architectural style, building stone source, and listed/ scheduled status
- A list of known (active and ceased) building stone sources such as quarries, mines, pits and delphs
- Additional information on building stones including lithology, grain size, sedimentary structures, key identification features, and notes on failure/weathering, and use.

The Building Stone GIS map allows you to search the Building Stones Database for England for:

- A building stone type in an area
- Details on individual mapped buildings or stone sources
- Potential sources of building stone sources within a given proximity of a stone building or area
- Buildings or stone sources in individual mineral planning authority area.

Further Reading, Online Resources and Contacts

The guide includes geological and building stone references for the area. A separate guide is provided on general Further Reading, Online Resources and Contacts.

Glossary

The guides include many geological terms. A separate Glossary explaining these terms is provided to be used alongside the guides.

The guides use the BGS lexicon of named rock units.

Mineral and local planning authorities

This guide covers the mineral planning authority area of Essex County Council, the mineral planning and unitary authority areas of Southend-on-Sea, and Thurrock; and the local planning authority areas of Uttlesford, Braintree, Colchester, Tendring, Harlow, Epping Forest, the City of Chelmsford, Maldon, Brentwood, Basildon, Rochford and Castle Point.

Contents

1 Introduction

The geology of Essex comprises sedimentary strata laid down during the Cretaceous, Palaeogene-Neogene (Tertiary) and Quaternary periods of geological time. The geological structure is relatively simple, with the Cretaceous-Neogene sediments being gently folded into the open trough-London Basin. This structure explains the presence of older rocks in northernmost and southernmost parts of the county and younger rocks in a broad, north-east to south-west trending belt extending roughly from Harwich to Waltham Abbey.

The oldest rocks exposed in Essex comprise marine chalks of Late Cretaceous age, assigned to the White Chalk Subgroup. These occur in the broader Saffron Walden area, in the north of the county, where they were formerly quarried on a relatively small scale. The chalks of southern Essex, which crop out around Tilbury and Purfleet, were once extensively quarried and used as a feedstock for the Portland cement industry.

Overlying the Cretaceous chalks is a variety of shallow marine or estuarine sands, clays and shell beds. These are assigned to the Montrose Group and the Lambeth Group, formerly referred to collectively as the 'Lower London Tertiaries'. Approximately 50 million years ago, the palaeo-environment of the Essex region changed dramatically, leading to the deposition of the London Clay Formation. This is a variably fossiliferous mudstone that was deposited in a subtropical sea. Above the London Clay, the mudstones give way to a series of clays and yellow sands, which are assigned to the Bagshot Formation. This formerly covered the whole county area, but erosion has now reduced it to a few isolated outcrops on hilltops in central and southern Essex. There is a major stratigraphical gap between the Bagshot Formation and the overlying 2.5 million-year-old deposits of the Red Crag Formation. The Red Crag used to cover much of northern Essex, although it is now only seen in a relatively large outlier lying to the north-west of Braintree and in a few isolated outcrops in north-eastern parts of the county, between Harwich and Walton-on-the-Naze (where it is well exposed).

The youngest sediments in Essex are referred to as drift or superficial deposits and these comprise sands, gravels, pebble beds, clays and tills laid down during Quaternary times. During the Quaternary, the River Thames initially flowed to the north of London, through northern Essex, Suffolk and Norfolk, and out across the present-day southern North Sea area to become a tributary of the Rhine. The resultant thick deposits of 'old Thames' river gravels (Kesgrave Catchment Subgroup) contain a variety of unusual pebbles (including chert, quartzite, metamorphic and igneous rocks) derived from

as far away as the Midlands and North Wales. The gravels also contain large boulders of puddingstone and Sarsen stone and have significant commercial value. They are worked in numerous pits between Harlow, Chelmsford and Colchester.

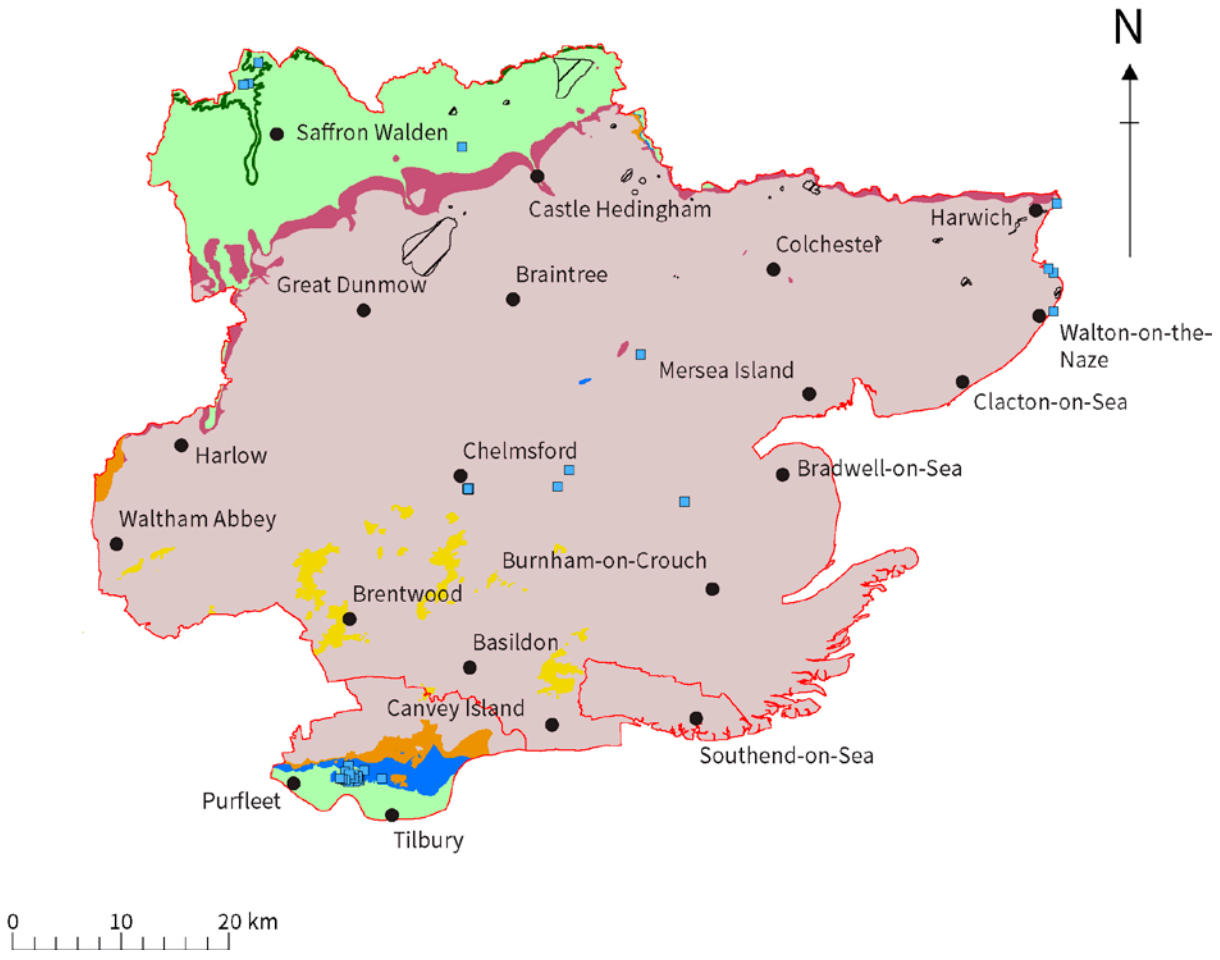
Around 450,000 years ago, the Anglian ice sheet spread southwards into the Essex region across the valley of the River Thames. Northwards of a rough line from Brentwood through Chelmsford to Colchester, this ice sheet deposited a widespread and substantial thickness of till (boulder clay), which contains erratic rocks that have been carried south by the ice from northern England, Scotland and Scandinavia. The ice meltwaters cut deep, steep-sided valleys in the underlying strata, which became filled with glacial sand, gravel and till deposits. These occur widely to the south of Colchester and to the east of Chelmsford, and are also evident in the valleys of the Brain, Ter, Pant, Stour and Blackwater. Glacial gravel is recognisable as an unsorted mixture of many outwash and intra-glacial rock types, although flint is one of its dominant constituents.

Essex has no commercially significant building stone resources, although considerable use has been made of several local stones for building in the past. The relative scarcity of geological building materials in Essex has necessitated frequent recycling of stone and brick since Roman times. For example, most church walls have been repeatedly repaired, rebuilt, re-faced and extended, each time reusing existing materials from exteriors, interiors and monuments. Occasionally, stone from other buildings, such as ecclesiastical buildings that were demolished after the Dissolution of the Monasteries, was also used. Some churches, such as St Mary with St Thomas Church at Broomfield, provide excellent examples of very varied recycling of different materials of all ages. These range from Roman brick and stone (including cementstone) to locally sourced cobbles.

Among the most commonly used building stones in the county are fresh flint–quarried as nodules directly from the White Chalk Subgroup, and Quaternary Flint gathered from unconsolidated glacial gravels, river terraces and beach deposits as pebbles and cobbles. A wide range of other pebbles, including chert, quartzite, vein quartz and various igneous and metamorphic rocks, have been dug from the gravels and cleared from soils developed on the gravel deposits. These have long been extensively used as local building stones. Indeed, these fieldstones are an important element in the fabrics of many parish churches in the county, and they represent the chief constituent of many dwellings, barns and enclosure walls. Although only sporadically developed, a quartz-cemented conglomerate containing rounded flint pebbles, known as Hertfordshire Puddingstone (Upnor Formation)has also been used for buildings. Other quartz-cemented sandstones, known as Sarsen stones, were employed in places, especially as foundation and cornerstones for farm and ecclesiastical buildings. The London Clay Formation (of Eocene age) yielded hard limestone concretions, known as cementstone or septaria. These were another locally important building stone resource and they were also used for cement.

Much of Essex lies within the London commuter belt, with radial transport links to the capital being intrinsically linked to the area's economy. There are nationally and regionally important ports and airports. However, with the exception of major towns such as Colchester, Chelmsford and Southend-on-Sea, the county is rural, with many small towns, villages and hamlets largely built in the traditional materials of timber and brick, with clay tile or thatched roofs. Only medieval, 19th-century churches and some halls and castles are constructed of stone, either wholly or in part.

Bedrock Geology Map



Key

Building stone sources

Bedrock geology

Extent of Crag Group Cover

Bagshot Formation — sand

Thames Group — clay, silt, sands and cementstones

Lambeth Group — clay, silt and sand

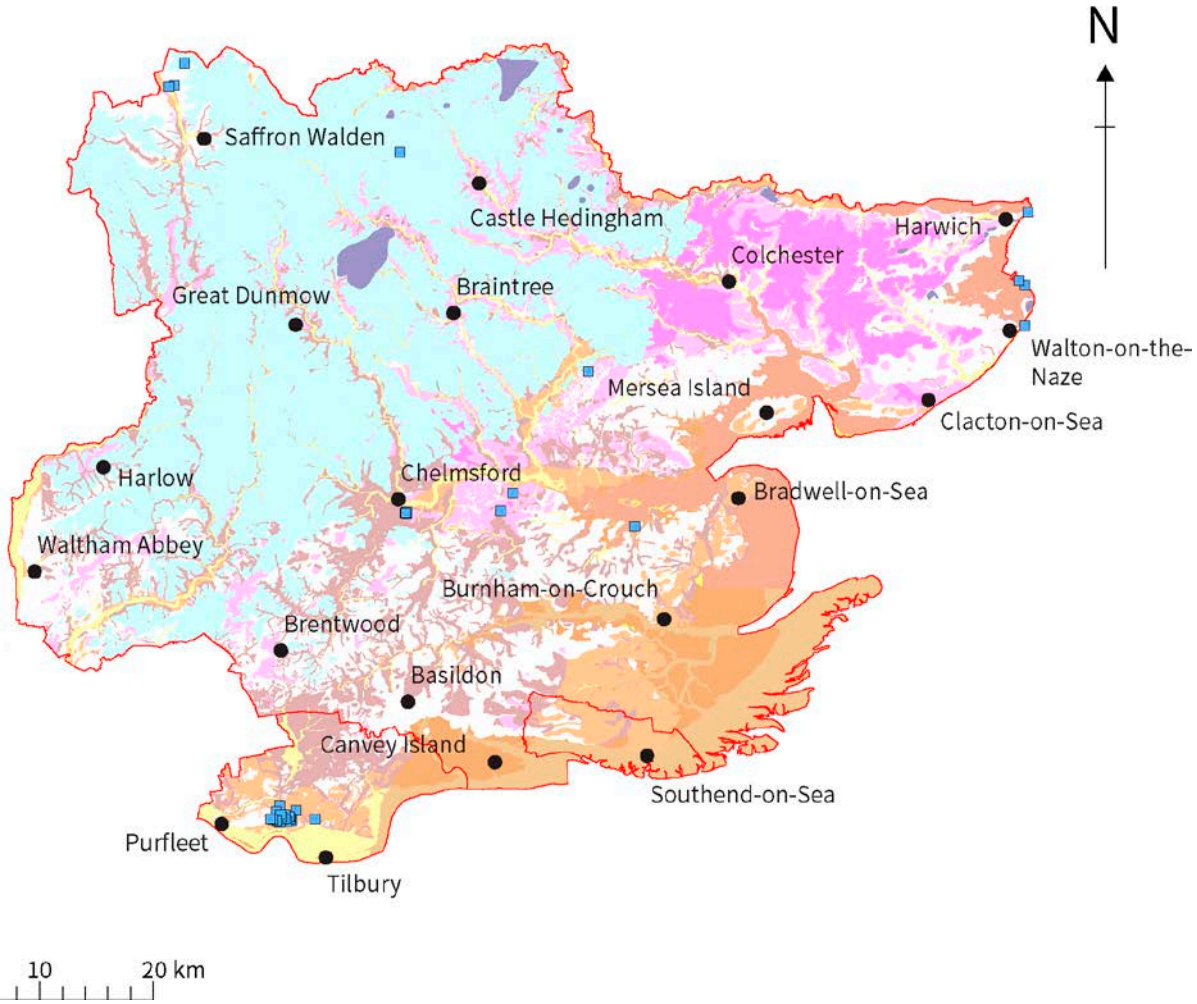
Thanet Formation and Lambeth Group (Undifferentiated) — clay, silt and sand

Thanet Formation — sand, silt and clay

White Chalk Subgroup — chalk

Chalk Rock Member — chalk

Superficial Geology Map



Key

- Building stone sources

Superficial geology

- Tufa — limestone
- Alluvium and Lacustrine Deposits — clay, silt, sands and gravels
- Coastal Deposits — clay, silt, sands and gravels
- Aeolian Deposits — sands
- Head — sands, gravels, silt and clay
- River Terraces — clay, silt, sands and gravels
- Glaciofluvial and Glaciolacustrine Deposits — sands, gravels, silt and clay
- Glacial Tills — clays, sand, gravel and boulders
- Crag Group — sands, gravels, silts and clays

Stratigraphic Table

Geological timescale	Group		Formation	Building stone	Page
Quaternary	Great Britain Superficial Deposits Supergroup	variously subdivided (including Kesgrave Catchment Subgroup)	variously subdivided	Tufa	49
				Pebbles and cobbles (Fieldstone)	46
				Quaternary Flint (Field Flint, River Terrace, Gravel Flint)	45
				Sarsen Stone (Silcrete, Sarsen)	43
				Hertfordshire Puddingstone	41
				Ferricrete, Ironstone, Ironpan	34
Neogene		Crag Group	Red Crag	Conglomeratic Ironstone (Conglomerate)	39
Palaeogene	Bracklesham Group		Bagshot Formation	Cinderstone	38
	Thames Group		London Clay Formation	Cementstone (Septaria, Septarian Nodules)	32
			Harwich Formation	Harwich Cementstone (Harwich Stone)	31
	Lambeth Group		Woolwich and Reading Beds		
			Upnor Formation		
	Montrose Group		Thanet Formation		
Upper Cretaceous	Chalk Group (part)	White Chalk Subgroup	Upper Chalk	Chalk (Clunch)	30
				Quarry Flint (Fresh Flint, Quarried Flint)	26
			Middle Chalk		

Building stones in geological order from the oldest through to the youngest layers.

2 The Use of Stone in Essex's Buildings

Background and historical context

Essex is the eighth largest county of England. There are more than 14,000 listed buildings. They range from the 7th-century Saxon Chapel of St Peter-on-the-Wall at Bradwell-on-Sea to the only complete Second World War Chain Home Radio Direction Finding tower in the UK, at Great Baddow.

Local building stone is scarce in Essex. Timber was the main material used for the construction of secular buildings throughout the medieval period, and many of these survive. The county has more timber-framed church towers and belfries than any other county in England.

In the medieval period, flint was used only for the most important buildings, such as churches or abbeys, and, to a lesser extent, farms and walls. Quaternary Flint (dug from local fields, river terraces and beach deposits) and Quarry Flint (sourced from Cretaceous chalk strata) were both employed, depending on availability. Most of the domestic flint buildings are found in the north-west of the county, where local Quarry Flint was readily available. These date from the 18th to the 19th century.

There was a limited supply of other local building stones, including ferricrete, Sarsen stone, cementstone, tufa, chalk, Hertfordshire Puddingstone and cobbles and pebbles (fieldstone). Many medieval churches use a mix of such materials in their walls. Chalk and Sarsen stone were predominantly employed in the north-west of the county.

Cementstone was much used by the Romans. The material was also often utilised for church walling, particularly in the southern half of the county and close to the coast and waterways. It was the main material used for Colchester's castle and for its town walls. Cementstone was also dredged from the sea off Harwich to make Roman cement for stucco for 18th and 19th-century buildings in London and elsewhere.

Many Saxon and early medieval churches make use of cobbles and pebbles and also recycled Roman brick and tile. The materials are found over a wide area of the county. The cobbles and pebbles include various sandstones, quartz, basalt, granites, rhyolite, porphyry, Carboniferous sandstones, Carboniferous limestones and Jurassic limestones.

Tufa was quarried from several sites near Braintree and Brentwood. It was used sparingly in churches, including St Germanus' Church at Faulkbourne,

All Saints' Church at Vange and SS Peter and Paul's Church at Stondon Massey. Tufa was also used as facings for the Roman Balkerne Gate in Colchester.

Many Norman and early medieval churches and castles used imported stones, including Lincolnshire Limestones from Barnack, Reigate Stone from Surrey, Caen Stone from France and Kentish Ragstone. Barnack Stone is found as a component of the walls of several medieval churches, along with other materials such as flint, cementstone and ferricrete. Caen Stone was used for the dressings to many 11th and 12th-century churches. Reigate Stone was also used for dressings in several churches in the south of the county. More than 200, mainly Saxon and early medieval, churches reused Roman brick, tile and cement stones for dressings, quoins and levelling courses.

Clay tiles were the predominant form of roofing material. The use of thatch is particularly common in the north-west of the county. Roofing slate only became common after the construction of the railways. In the north of the county, clay lump was used particularly for cottages during the 18th and 19th centuries.

Colchester is Britain's oldest recorded town. It was initially the most important city in Roman Britain. Extensive remains of the town's stone wall survive. Saxon minsters were established at Bradwell-on-Sea, Tilbury and Waltham. Churches were often initially of timber, although some 7th-century stone fabric survives, including in the Chapel of St Peter-on-the-Wall at Bradwell-on-Sea and the Church of St Mary the Virgin at Prittlewell.

Before the Dissolution of the monasteries in the 16th century, religious communities had a significant influence on the landscape, economy and use of building stone in Essex. There were some 50 establishments. They owned extensive areas of land and manors, controlled many parish churches and established market towns such as Braintree, Great Dunmow, Epping and Witham.

After the Dissolution, stone from abbeys and monasteries was widely plundered. Many buildings were converted to houses, or new houses were built on their sites. Parts of nine monastic churches survive in the county. They include the naves of Abbey, Hatfield Broad Oak, Hatfield Peverel and Blackmore, all now parish churches.

After the Norman Conquest in the 11th century, 19 castles were established in Essex to help protect the new nobles and to control the Saxon population. At Chipping Ongar, Castle Hedingham, Pleshey and Saffron Walden, castles were built in conjunction with new towns. The keep to Colchester Castle is the largest in area of any medieval keep built in Europe.

There are more than 600 Anglican parishes, of which 410 are medieval. The remainder are 19th to 20th century. In many areas of the county, churches are the most significant stone-built structures. At least 300 churches and

chapels were in existence before 1200. Most of the pre-Reformation churches developed piecemeal over the centuries. They were altered, enlarged and added to, and exhibit a mixture of features, fabric and building materials.

The 14th century was beset by economic and social unrest, poor harvests, wars, epidemics and rebellion. The Black Death and economic decline led to a significant reduction in population and changes in land holdings. Population numbers did not recover until the 18th century. However, in the late 14th century and early 15th century, the population of London grew rapidly, and the prosperity of Essex increased dramatically due to the wealthy market on its doorstep. The existing small-scale cloth industry expanded rapidly. By the 1390s, it was equal to that of Suffolk. The wealth funded the large 15th-century churches of Saffron Walden, Thaxted and Dedham, and the improvement of many churches in the county.

From the early 14th century, knapping and squaring of flints to produce flat surfaces became common. High-quality flushwork of flint and ashlar became very fashionable in the late 15th century, particularly as ornamentation to towers, parapets, plinths and new porches. Fine examples are found in the gatehouses of St Osyth Priory, Clacton-on-Sea, and St John's Abbey, Colchester.

Few churches were built between the mid-16th century and the 19th century. Nearly all are of brick. Most of the non-conformist chapels of the county are also built of brick. Brick became widely available for modest housing in the 18th century as a result of improvements in transportation.

By the 1740s, the cloth industry was generally in decline. Arable farming increased in response to demand from London for wheat and barley, particularly for brewing. The growing wealth of the county led to the building of fine civic buildings, such as Shire Hall, Chelmsford, with its classic facade of Portland Stone.

Defensive structures have been built along the coast of Essex since the Roman period. Henry VII constructed a series of defensive blockhouses in the 15th century and further forts were built in the ensuing centuries. A series of Martello towers were built in the early 19th century, mainly of brick. Several sites were rebuilt later in the century and further defences created in the 20th century.

In the 19th century, the construction of the railway network facilitated commuting and, on the coast, tourism. Southend and Clacton grew rapidly. In the 1880s, the strong growth of residential building began to seriously change the character of what is now Metropolitan Essex. It led to a need for new churches and parishes. Catholic emancipation in 1829 had also encouraged the building of new churches, at Brentwood, Colchester, Chelmsford, Witham and Chipping Ongar, for example. The railways enabled the importation of a wide range of building materials, including Bargate Stone, Ancaster Stone, Ketton Stone and other limestones such as Bath Stone and Portland Stone. Kentish Ragstone was the most common material for 19th-century churches.

Almost as many schools as churches were built in the 19th century. Flint was used in the north-west of the county. Notable civic buildings of the period include Colchester town hall, constructed of brick with Portland Stone dressings.

After the Second World War, the Metropolitan Green Belt was established to prevent the further sprawl of London into the county. New towns were built at Basildon and Harlow. Significant expansion has taken place in the major towns of Essex and particularly in the south-west since the opening of the M25 and the continuing industrial development of the Thames Estuary area.

Natural Character Areas

Local landscape character and the combination of history, cultural and economic activity, geodiversity and biodiversity has been mapped for the whole of England and national Natural Character Areas (NCA) defined (see Further reading). For each NCA there is a profile document which describes the natural and cultural features that shape the landscapes, how the landscapes have changed over time, the current key drivers for ongoing change, and a broad analysis of each area's characteristics and ecosystem services. The profiles include notes on local vernacular and building materials which are expanded in the following section on the five NCAs covered by the guide:

NCA 81 Greater Thames Estuary
NCA 82 Suffolk Coast and Heaths
NCA 86 South Suffolk and North Essex Clayland
NCA 87 East Anglian Chalk
NCA 111 Northern Thames Basin

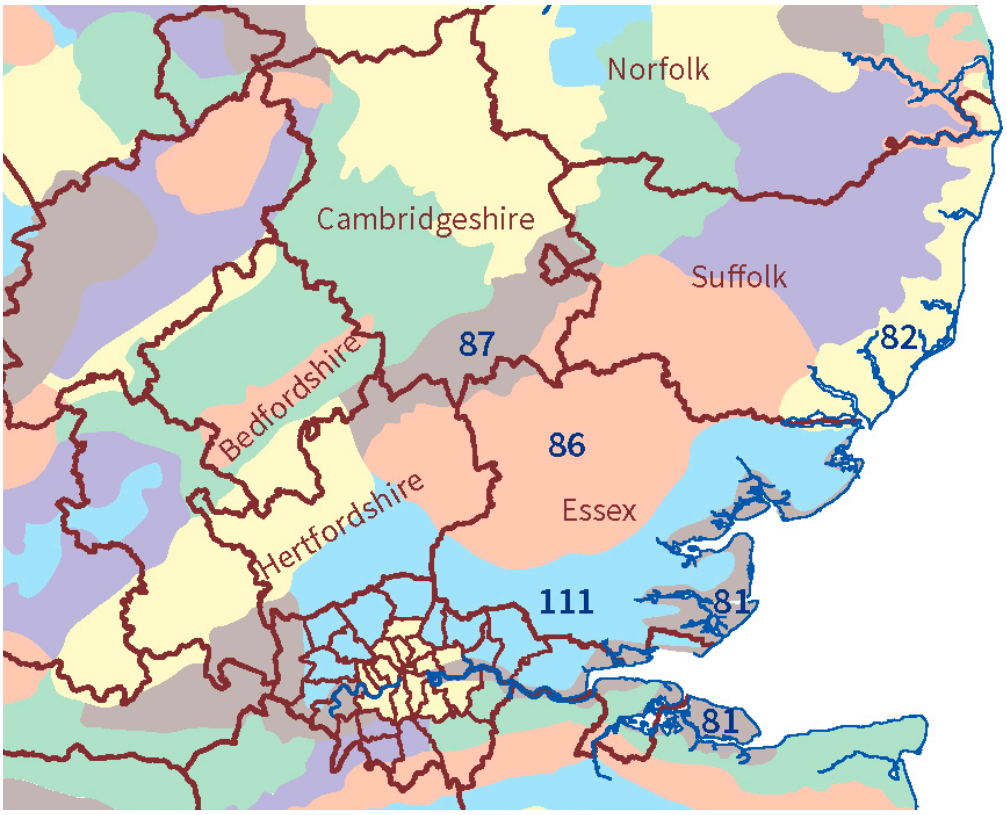


Figure 1: Map showing the National Character Areas (and the NCA numbers).

Greater Thames Estuary

Greater Thames Estuary NCA lies between the North Sea/Thames Estuary and the rising ground of the adjacent Northern Thames Basin NCA. It stretches for almost the entire length of the Essex coast; estuaries and marshlands give Essex the longest coastline of any county. There are more than 480km of sea wall. The estuaries of the Rivers Crouch, Roach, Blackwater, Colne and Stour and the embayment of Hamford Water form three major peninsulas: Tendring, between the Stour and the Colne; Dengie, between the Blackwater and the Crouch; and Rochford, between the Crouch and the Thames.

The area contains some of the least settled parts of the English coast, with few major settlements. Nucleated villages occur, but the historic settlement pattern was largely dispersed, with small hamlets, isolated farmsteads, churches and associated manors located on the higher ground at the edge of the marshes. The local vernacular is predominantly of red brick and weatherboarding. Many pre-1750s timber-framed buildings survive, particularly farmhouses, medieval barns and later aisled barns.

Most medieval churches were built of a variety of building materials, including flint, cementstone, ferricrete and limestones, with Roman tile and brick dressings. Flint was often used as a major component of church walls in the area. Knapped flint banding and chequerwork with ashlar are found in a number of churches. Unusually, the 14th-century tower of St Andrew's Church at Fingringhoe is totally banded, except for chequerwork at its base. The banding is of flint rubble and ashlar. The 15th-century south porch also has a chequerwork base and parapet. The 19th-century south chapel at Fingringhoe has banding of knapped flint and brick panels. The Church of St Edmund King and Martyr at East Mersea has a 14th-century tower of coursed rubble and flint, with flushwork dedication crosses and chequered plinth. All Saints' Church at Brightlingsea has a fine flint-built 15th-century tower with flushwork. It was restored in the 19th century after the Colchester earthquake of 1874. Flint was the predominant material used for the extension and for the construction of several new 19th-century churches. Cementstone was also frequently employed in medieval churches of the area.

Kentish Ragstone was used in several medieval structures. For example, Hadleigh Castle, overlooking the Thames Estuary and Canvey Island, is built of Kentish Ragstone with a mortar containing a large proportion of seashells. Rochford Hall, once one of the largest houses in the county, was rebuilt in *c* 1540–50, mainly of Kentish Ragstone reused from Prittlewell Priory. St Clement's Church at West Thurrock has a 13th-century nave and chancel and a 15th-century tower of Quaternary Flint, with Kentish Ragstone, Quarry Flint and some Reigate Stone dressings.

The expansion of the railway system in the mid-19th century stimulated the growth of seaside resorts, such as Southend, Clacton and Frinton. Kentish Ragstone was often used in the 19th and early 20th-century churches built to serve their populations. Examples include St Clement's Church at Leigh-on-Sea and Holy Trinity Church at Southchurch.

At Tilbury Fort, Portland Stone was used for the elaborate outer facade to the two-storey watergate. Granites and limestones were imported for use in the 11 Martello towers built between 1808 and 1812 along the coast of Essex in response to the Napoleonic threat. Only six survive.

Figure 2: Watergate, Tilbury Fort. Portland Stone.

Frinton-on-Sea was largely developed as an exclusive Edwardian seaside suburb in the early 20th century. Large houses in a mixture of styles, influenced by the Arts and Crafts Movement or neo-Tudor architecture, predominate. The Homestead is a fine house designed by C F A Voysey, with the roughcast render, Bath Stone dressings and Westmorland Slate roof that are typical of much of his work.

Suffolk Coast and Heaths

A small area of the Suffolk Coast and Heaths NCA lies at the far north-east of the county, along the south bank of the Stour Estuary from Harwich to Manningtree. The area includes the settlements of Parkeston, Manningtree, Mistley and Ramsey, as well as the historic centre of Harwich.

Most of the buildings of the area date from the 18th century onwards and are largely constructed of brick. The Church of St Mary and St Michael at Mistley was built to replace a church by Robert Adam that was largely demolished in 1870. It is built of Kentish Ragstone, with Bath Stone dressings and tiled roofs. Mistley became an important centre for malting from the 18th century with the construction of a quay. Unusually, a small section of wall to one of the malting sites east of the post office in the High Street is built of a range of exotic stones that came as a ship's ballast from Norway.

Figure 3: Church of St Mary and St Michael, Mistley. Kentish Ragstone with Bath Stone dressings.

At the mouth of the Rivers Orwell and Stour, Harwich developed as the only significant port between Great Yarmouth and London. It became a free borough in 1318. During the 17th to 19th centuries, it was an important naval dockyard. The majority of the buildings in the town are of brick, often with stone dressings. Harwich Redoubt formed part of the chain of defences built in the Napoleonic period. It is a circular tower of brick, with granite and limestone embrasures.

In the 18th century, Harwich became the main centre for the Roman cement industry. The material was made from cementstone collected from the foreshore, excavated from the cliffs and later dredged from offshore. It was widely exported and used for most of the purposes for which Portland cement is produced today. During the Regency period, stucco was made from the material and used particularly by John Nash for buildings in London.

South Suffolk and North Essex Clayland

This NCA covers much of central and north Essex, south and western Suffolk, east Hertfordshire and a relatively small part of the south-east of Cambridgeshire. There are many notable medieval towns, including Chelmsford (the county town of Essex), Witham, Chipping Ongar, Harlow, Saffron Walden, Great Dunmow, Halstead, Braintree and Thaxted, as well as numerous villages such as Stansted Mountfitchet, the Rodings, Manuden, Arkesden, Kelvedon, Finchingfield, West Bergholt, Coggeshall, Writtle, the Colnes and the Hedinghams.

Many vernacular buildings from the 13th to the 17th century survive. Elaborate timber-frame buildings with exposed timbers, colour-washed render and steeply pitched roofs with peg tiles or long straw thatch are characteristic of the area. Pargeting, decorative external wall plaster, was popular in the 17th century.

Flint was used in the construction of several castles in the area. The keep of Hedingham Castle has walls constructed from flint rubble, faced with Lincolnshire Limestone ashlar brought from Barnack, Northamptonshire. At Walden Castle, Saffron Walden, only the ruined flint core of the walls and parts of the keep remain.

Large monastic foundations located outside the area were hugely influential in the medieval period. They controlled parishes, manors and markets in the area. After the Dissolution, parts of monastic churches occasionally became or were incorporated into parish churches. At Little Dunmow, the lady chapel of the priory became the parish church. It is built of flint and limestone rubble. At Tilty and Coggeshall, the gate chapels survive as the Church of St Mary the Virgin and the Chapel of St Nicholas, respectively.

Many monastic establishments were replaced by domestic houses after the Dissolution. At Walden Abbey near Saffron Walden, Audley End House was built on the site. It was constructed of brick and faced in chalk. The stone has

Figure 4: Hedingham Castle. Flint rubble with Lincolnshire Limestone.

been extensively replaced since the 18th century, with imported limestone from Chilmark, Wiltshire, and Ketton, Rutland.

The churches of the area are generally built of a mixture of materials, reflecting the limited availability of good quality stone. Quarry and/or Quaternary Flint pebble rubble predominate, commonly with the use of cobbles and pebbles, ferricrete, chalk and reused Roman tile. They were often heavily restored in the 19th century, when much stone recycling and resurfacing work were undertaken, using a mixture of stones but predominantly flint. There is a relative wealth of 11th and 12th-century churches. Round towers are rare in the county and are largely confined to this NCA. They include Broomfield, Great Leighs, Pentlow and Lamarsh. They are generally built of flint, sometimes with Roman brick and tile.

On the Suffolk border, flint with chalk dressings was relatively common. Flint flushwork is found in a considerable number of churches in the area. Roman brick, Sarsen stone and sometimes flint were used for quoins and dressings in early churches.

In the south, around Braintree and towards Colchester, a variety of ferricrete (Conglomeratic Ironstone) was often used. It is found in churches such as Holy Trinity Church at Bradwell, St Andrew's Church at Boreham and the west tower of St Peter's Church at Boxted. In places, Sarsen stones were used as foundation stones.

Figure 5: Church of St Gregory and St George, Pentlow. Whole flints, pebbles and cobbles with large flint quoins.

Figure 6: Holy Trinity Church, Bradwell. Flint, pebble and cobble rubble, ferricrete and Roman tile.

Tufa, likely sourced from several sites along the Rivers Ter and Brain, was used in St Germanus' Church at Faulkbourne. In the north-west of the area, St Helen's Chapel at Wicken Bonhunt is a rare example of a complete Norman chapel. It has walls built almost entirely of cobbles and pebbles obtained from the local fields. Blocks of Sarsen stone and Hertfordshire Puddingstone are also present.

The wool and cloth trade of the 13th to 17th centuries generated much wealth in the area. In the 15th to 16th century, rich merchants and their families, such as the Webbes at Dedham, endowed the rebuilding of churches at Thaxted, Dedham and Saffron Walden. The Church of St John the Baptist at Thaxted is of Quaternary Flint rubble, including limestone and chalk dressings and an impressive chalk clerestory. The Church of St Mary the Virgin at Dedham has walls of flint and other rubblestone. And the Church of St Mary the Virgin at Saffron Walden, the largest non-cathedral church in Essex, is built of chalk ashlar and flint pebbles.

The wool and cloth trade largely declined in the 17th century, outcompeted by northern and western England. During the 18th and 19th centuries, the need to feed the London market led to investment and experimentation in farming. Large-scale farming became increasingly prevalent. Many estates were amalgamated. Grand Palladian houses in landscaped parks were built, such as the Georgian Kelvedon Hall and Thorndon Hall. From the 18th century, cobbles of Quaternary Flint and other local stones were often used for cottages, boundary walls and agricultural buildings.

The towns largely de-industrialised, but they became important agricultural centres. At the end of the 18th century, civic improvements took place in Chelmsford, for example. A new jail was built in 1777, and in 1787 a new stone bridge was constructed of Portland Stone. The Shire Hall is built largely of brick, but it has a fine Portland Stone front elevation.

In the 19th century, new churches were erected in the larger towns, often in brick with stone dressings. Flint was also widely used. For example, Holy Trinity Church at Halsted, by George Gilbert Scott and William Bonython Moffat, is of brick with flint facing, and St James' Church at Greenstead Green, by Scott, is of coursed flint and pebbles with stone dressings. The Roman Catholic Church of Our Lady Immaculate at Chelmsford is made of fine knapped flint, with stone dressings and a Welsh slate roof.

Figure 7: HM Prison, Chelmsford. Portland stone facade.

The diocese of Essex was created in 1913. Chelmsford's parish church became the Cathedral Church of St Mary the Virgin. In 1908, it was expanded with the extension of the chancel and a new chapter house; the walls are constructed of a mixture of cobbles.

The advent of the railways led to the importation of a wider range of materials. All Saints' Church at East Hanningfield is of London brick, faced with Kentish Ragstone and ferricrete with Bath Stone dressings. Civic and commercial buildings often used imported stones. For example, in Saffron Walden, the facade of 3 King Street makes use of Ancaster Stone and that of 12a Market Street is Portland Stone. The market cross uses York Stone, Ancaster Stone and red Permo-Triassic sandstone.

Many rural schools and parish workhouses were built in the 19th century. Most were of brick. Flint and brick with stone dressings was occasionally used. For example, the Old School at Greenstead Green, by Scott, is built of Quaternary Flint cobbles, and Radwinter School, near Saffron Walden, extended by W E Nesfield, is of flint rubble and brick.

Figure 8: Radwinter School, Radwinter. Flint rubble and brick.

East Anglian Chalk

The East Anglian Chalk of Bedfordshire, Cambridgeshire, Hertfordshire, Suffolk and north-west Essex is part of the narrow ridge of chalk that runs south-west to north-east across southern England, from Devon to the eastern edge of The Wash. Only a small area of north-west Essex, north of Saffron Walden, lies within the East Anglian Chalk NCA. It includes the villages of Great Chesterford, Littlebury, Elmdon, Chrishall, Little Walden and Hadstock. The South Suffolk and North Essex Claylands lie to the south.

Flint was the predominant material used in the area's medieval churches. The Church of St Mary the Virgin at Strethall has a fine small Anglo-Saxon nave of flint rubble, with long and short work. Another example is St Botolph's Church at Hadstock possibly originated as a minster church. The nave and north transept are 11th century. All Saints' Church at Great Chesterford has a plinth course in ashlar. The flint work includes some cobbles and pebbles, chalk and limestone.

The use of stone in medieval domestic buildings in the area was very rare. Unusually, Little Chesterford Manor has a 13th-century stone wing of flint rubble and stone facings. Close by, Priors Hall, Widdington, is also built of stone. Both lie on the upper reaches of the River Cam. The facing stone was probably transported by water from west of The Wash.

Throughout the medieval period and up until the 19th century, the area was characterised by large areas of arable land in common fields. After enclosure of the fields between 1805 and 1829, flint and brick became quite widely used for farm outbuildings, cottages and boundary walls. For example, flint and brick boundary walls are a characteristic feature of dwellings such as Flint Cottage, Great Chesterford.

The majority of the area's churches were rebuilt or extended in the 19th century. Holy Trinity Church at Littlebury has a 19th-century chancel and was extensively restored in 1870–1 with flint facing and Bath Stone dressings. The Church of St Nicholas at Elmdon was restored in 1847, a new chancel was added in 1879–80 and a south chapel was built in 1905, all in flint.

Great Chesterford Primary School is a fine example of a mid-19th-century village school built of knapped Quarry Flint and Quaternary Flint, with Bath Stone dressings. It reflects the availability of stone sourced from further afield following the opening of the railway in 1845.

Northern Thames Basin

The Northern Thames Basin extends from Hertfordshire in the west to the Essex coast in the east. It is separated from the North Sea and Thames Estuary by a narrow band of land that makes up the Greater Thames Estuary NCA and by the Suffolk Coast and Heaths NCA along the south bank of the Stour Estuary in the far north-east of the county. The South Suffolk and North Essex Clayland lies to the north. The Northern Thames Basin NCA has three relatively distinct areas with differing landscapes, histories of settlement and land use. The Essex Wooded Hills and Ridges lie mainly to the north-west and the Essex heathlands to the north-east. The London Clay lowlands form the rest of the NCA, from Waltham Abbey in the west to Maldon in the east. There was considerable variation in the availability and use of local and imported stone between the three areas. However, timber-framed buildings were dominant during the medieval period. Exposed framing was often later covered by weatherboarding, colour-washed render and, from the late 17th century, brick.

Essex Wooded Hills and Ridges

The Essex Wooded Hills and Ridges extend roughly from Epping Forest in the west to Danbury in the east. It consists of a series of hills and ridges created by the Bagshot Sands, which rise up above the clay lowland. The area includes the former royal forests of Hainault and Epping. Settlement was sparse in the medieval period, with scattered villages associated with the extensive commons or the management of wood pasture and other resources belonging to monastic houses.

The medieval churches of the area are generally of flint. For example, All Saints' Church at Theydon Garnon is built of flint rubble, with a 16th-century west tower and aisle in brick. Further east, the use of Conglomeratic Ironstone is relatively frequent. For example, the Church of St John the Baptist at Danbury is built of flint, cobbles, pebbles and ferricrete (Conglomeratic Ironstone variety), with stone dressings and some knapped flint. The 19th-century south aisle is almost entirely conglomerate. From the 16th century, the use of brick for replacement and new church structures became common in the area.

Transport improvements in the 19th century led to the easier availability of a wider range of stone. In the east, near the River Blackwater, St Bartholomew's Church at Wickham Bishops is built of Kentish Ragstone, with Caen Stone dressings. In the west, All Saints' Church at Chigwell Row is of brick, faced with Bargate Stone with Bath Stone dressings. The Church of St John the Baptist at Epping is built of Bath Stone ashlar.

The area has attracted the rich since at least the 16th century. Most of the mansions were built of brick. The grand Palladian house of Thorndon Hall, Ingrave, by James Paine, has a rusticated limestone ground floor and a six-column giant Corinthian portico with a Welsh slate roof.

Figure 9: Thorndon Hall, Ingrave. Limestone rustication and columns.

London Clay lowlands

The London Clay lowlands lie to the south and east of the Essex Wooded Hills and Ridges. The area includes the Lee Valley and Waltham Cross on the western border of the county and London's outer eastern suburbs, including Loughton, Grays and Thurrock. Historic market towns such as Brentwood, Billericay, Wickford, Rayleigh, Laindon and Maldon lie within the area, together with the new town of Basildon and the more recent settlement of South Woodham Ferrers. The lowlands also include the areas of the Rochford and Dengie peninsulas and their settlements, such as Southend-on-Sea and Southminster. The vernacular buildings of the area were predominantly timber framed, with plain tiled roofs. The use of weatherboarding was usually more typical than colour-washed render as the main walling material. Weatherboarding was traditionally painted black or tarred.

Local stone, particularly Quaternary Flint, ferricrete, Sarsen Stone and cobbles and pebbles, was used for significant buildings, such as abbeys and churches in the medieval period. The proximity to the coast and river network enabled the importation of stone, including cementstone, Kentish Ragstone, Barnack Stone and Caen Stone, from an early date.

Monastic foundations played a significant role in the development of the area. For example, the monks of St Osyth founded the town of Brentwood in 1177. There were also many religious establishments, such as Waltham Abbey, Blackmore Priory, Beeleigh Abbey, Burstead Grange, Prittlewell Priory, Tolleshunt Monastery, Stansgate Priory and Tiptree Priory.

Waltham Abbey originated in the 7th century. By the 13th century, the monastery had become the most important Augustinian house in England. The current parish church consists of the nave of the Norman abbey church and the 14th-century lady chapel. It is built of flint, with ferricrete, Barnack Stone, Caen Stone, Reigate Stone and Kentish Ragstone. The surviving wall of the Chapter House is mainly of Kentish Ragstone, but it has recycled pillars of Purbeck Marble within its rubble masonry. After the Dissolution, a west tower was added in flint and stone chequerwork. Much knapped flint was used in the 19th-century restorations and additions of William Burges.

A wide range of materials was often used in medieval churches of the area. For example, the walls of SS Peter and Paul's Church at Stondon Massey are built of Quaternary Flint rubble with Roman tiles and tufa. The nave of SS Edmund and Mary's Church at Ingatestone is of coursed rectangular blocks of ferricrete (including the Conglomeratic Ironstone variety) with pebble rubble, Roman brick and tiles. Flint flushwork and chequerwork are found in some churches of the area. Unusually, at St Andrew's Church at Rochford and the Church of St Nicholas at Canewdon, on the Rochford peninsula, very rough Kentish Ragstone was used with flint for flushwork. Knapped flint banding with ashlar is found in several churches, including the 14th-century tower of All Saints' Church at Purleigh. Near the coast, cementstone was often used, including in the Church of St James at Dengie and St Margaret's Church at Woodham Mortimer.

Imported materials were often employed close to the coast. In the west of the area, Reigate Stone dressings were used in the largely flint and Kentish Ragstone rubble at St Mary's Church at North Stifford. Holy Trinity Church at Rayleigh on the Rochford peninsula is of Kentish Ragstone and flint rubble, with a few blocks of ferricrete, some knapped flint and bricks. The blocks of Kentish Ragstone in the tower and the limestone dressings are probably reused from nearby Rayleigh Castle.

The construction of railways from the 1840s led to the rapid expansion of London suburbs into the south-west of the area, the growth of market towns such as Brentwood and the establishment of the seaside resort of Southend-on-Sea. In response to the increasing population, new churches were constructed, including the Church of St Thomas of Canterbury at Brentwood by E C Lee in the Arts and Crafts style. The walls contain a great variety of stones, such as Quaternary Flint, Sarsen stone and cobbles and pebbles (including chert, quartzite and vein quartz). The rail network made a greater range of stones available. Holy Cross and All Saints' Church at Warley, a Roman Catholic mission church by F W Tasker, was built of Millstone Grit (Lancaster Stone) blockwork, with Ancaster Stone and Bath Stone dressings.

Many churches were restored, extended or rebuilt in the 19th century. Often, they were re-faced in flint. Imported stones were used for dressings and repairs. The Church of St Nicholas at South Ockendon has an 11th-century round tower, and is one of the best in Essex. It was resurfaced in knapped flint and Reigate Stone dressings in 1865–6. St Nicholas' Church at Rawreth was rebuilt in Kentish Ragstone with Bath Stone dressings and some flushwork, but retained its 15th-century west tower. On the Dengie peninsula, the Church of St Lawrence and All Saints at Steeple was rebuilt in 1881–3, reusing material from the medieval church, including cementstone with fragments of dressed limestone and brick, all randomly arranged.

Figure 10: St Nicholas' Church, Rawreth. Kentish Ragstone with flint flushwork and Bath Stone dressings.

The Church of SS Mary and Helen at Brentwood was raised to cathedral status in 1917. Quinlan Terry enlarged the building between 1989 and 1991, incorporating the church of 1860–1. Both are principally faced in Kentish Ragstone. Terry's work includes Doric pilasters and a portico of Portland Stone.

Essex heathlands

The area is broadly bounded by the Stour Estuary to the north and the Thames Estuary to the south and east, covering the land around Colchester and the inland area of the Tendring peninsula. The principal settlement is Colchester. Other towns and villages include West Bergholt, Elmstead Market, Lawford, Dedham, Bradfield, Dovercourt, the Oakleys, Thorpe-le-Soken and much of Clacton-on-Sea. Historically, extensive heaths and commons dominated the area, particularly north of Colchester as far as Dedham. Vernacular buildings were largely constructed of timber, with either weatherboarding or colour-washed render. The latter was used more extensively in this area than in the London Clay lowlands. The use of brick was common in the north on the heathlands.

Colchester was initially the most important city in Roman Britain. Notable buildings included three theatres, the only Roman chariot-racing circus in the country and the Temple of Claudius, the largest building of its kind in Roman Britain. Colchester Castle was built on the substructure of the temple. It is the largest Norman keep in existence. The walls are made of coursed rubble, including cementstone and Roman brick robbed from nearby ruins. Ashlar dressings are of Barnack Stone and other stones, including Caen Stone, as well as Roman tile and brick. The circus was built of sandstone brought from Kent. It possibly had a facing of Purbeck Marble. There are extensive remains of the town's stone walls, built after the revolt by Boudica in AD 60-61. They are constructed of alternating courses of cementstone and mortar, faced with cementstone and tile bands. Remains of two of the eight gates survive, including the Balkerne Gate. Its monumental double arch is faced with tufa.

The standing remains of the Benedictine Abbey of St John are now limited to sections of the precinct wall and the abbey gatehouse. The latter has fine flint flushwork. The precinct wall is constructed in flint, Kentish Ragstone and reused Roman brick. St Botolph's Priory was the first house of Augustinian canons in England. The ruins of the nave remain. It was built of Kentish Ragstone and cementstone, with much Roman brick and brick dressings.

There were eight medieval churches within the walls of Colchester and three beyond. A variety of stones were used. All Saints' Church, now the Natural History Museum, is built of flint and cement stones with ashlar dressings, 19th-century facing in Kentish Ragstone and knapped flint, with Caen and Portland Stone dressings. Holy Trinity Church has a fine pre-Conquest west tower built of flint rubble, Kentish Ragstone and cement stones, with reused Roman brick and tile. St Peter's Church is of mixed rubble with cement stones, brick and Kentish Ragstone, as well as some dressings of Reigate Stone.

North-west of Colchester, Old St Mary's Church at West Bergholt is built of flint and cobbles and pebbles (including chert and quartzite), ferricrete and limestone. The Church of St Mary the Virgin at Lawford has knapped flint with brick and some Harwich Stone flushwork to the chancel. The medieval churches of the Tendring peninsula are also constructed of a variety of materials. For example, St Mary's Church at Great Bentley is built of regularly coursed and herringboned ferricrete, with cobbles and pebbles and cement stones. The quoins and doorways are of Barnack Stone and there are ferricrete dressings to original windows.

St George's Church at Great Bromley has a fine late 15th-century tower constructed largely of ferricrete; the 15th to 16th-century south porch and nave clerestory have much flint flushwork. The Church of St John the Baptist at Great Clacton is predominantly built of cement stones with some mixed flint rubble and erratic pebbles and cobbles, with limestone and brick dressings.

Colchester's cloth trade with the Hanseatic League became important from the late 14th century. The cloth industry further expanded in the 16th and 17th centuries, with the arrival of Dutch and Flemish immigrants. Bourne Mill, Colchester, originated as a fishing lodge to St John's Abbey. In 1640, it was converted to a fulling mill for the wool trade. Barnack Stone from St John's Abbey was reused in its construction, together with local cement stones.

In the 19th century, many churches in rural areas were restored, extended or rebuilt, using both local and imported materials. St Mary's Church at Ardleigh is built of flint, cobbles and pebbles, ferricrete, cement stones and Roman brick, with dressings of brick and limestone. The west tower and south porch are 15th century. The latter has fine flushwork, with its knapped flint probably brought from Suffolk. St Michael's Church at Thorpe-le-Soken was partly rebuilt in 1875. Permo-Triassic red sandstone was used for replacement dressings to many of the windows and the door to the re-faced north elevation. In Colchester, brick was largely used for the 19th-century churches built to serve the expanding population, but imported stones were often used for the dressings. All Saints' Church has Caen Stone dressings and the Church of St John the Evangelist displays Ancaster Stone dressings.

In Colchester, civic and commercial buildings occasionally made use of imported stone in the 19th and 20th centuries. The former Corn Exchange in the High Street is built of Bath Stone; and the public house at 128 High Street has a Portland Stone and Bath Stone ashlar facade, with some Art Nouveau detailing. Colchester town hall, designed by John Belcher, is of brick with Portland Stone. In Maidenburgh Street, Victorian granite and granodiorite paving setts survive, with cart wheel-worn grooves. The octagonal United Reformed Church, Lion Walk, by David Roberts, made use of Kentish Ragstone and Caen Stone cladding, replacing the Caen Stone Gothic church of 1862 but retaining its tower and steeple.

Figure 11: 128 High Street, Colchester. Portland Stone with Bath Stone facade.

3 Local Building Stones

Upper Cretaceous

Chalk Group, White Chalk Subgroup, Middle Chalk Formation and Upper Chalk Formation

Quarry Flint (Fresh Flint, Quarried Flint)

Quarry Flint occurs as bands or isolated nodules within the chalky limestone beds of the White Chalk Subgroup. It is an extremely fine-grained (cryptocrystalline) and hard form of silica containing microscopic quartz-crystal aggregates. Quarry Flint usually occurs as irregularly shaped nodules that are 100 to 200mm across, or as (sub-) rounded pebbles or cobbles. Occasionally, it is also found as weakly banded tabular sheets or layers up to 200mm thick. The colour is very distinctive: fresh nodules have a white outer cortex with a black or dark grey interior.

Quarry Flint breaks with a characteristic conchoidal fracture, producing razor-sharp fine edges. The knapped surfaces may exhibit Liesegang banding. Flint nodules may contain cavities lined with translucent botryoidal chalcedony or small transparent quartz crystals. Some nodules contain well-preserved fossils, with echinoids, sponges, bivalves, burrow structures and occasionally belemnites being encountered.

The Upper Cretaceous Chalk succession in Essex has yielded much Quarry Flint for local building purposes. Where encountered, it often occurs in association with Quaternary Flint. It was employed in a variety of ways, including as knapped, faced or trimmed stone and sometimes in squared chequerwork. Particularly fine examples can be seen at the Church of St Clements at West Thurrock, which exhibits spectacular polychromatic banding of Quarry Flint and Kentish Ragstone, and at St Osyth's Priory gatehouse.

Quarry Flint was used in All Saints' Church at Terling, where the flints contain body and trace fossils, and in St John the Baptist Church at Little Maplestead, which features knapped Quarry Flint in the porch and Quaternary Flint in the walls.

The extremely hard and resistant nature of Quarry Flint-type nodules has resulted in them having been recycled by natural processes into younger deposits.

Figure 12: Church of St Clements, West Thurrock. Quarry Flint and Kentish Ragstone banding with Reigate Stone dressings.

Figure 13: Church of St Clements, West Thurrock. Quarry Flint and Kentish Ragstone banding.

Figure 14: Priory of St Osyth, near Clacton-on-Sea. Flint flushwork.

Figure 15: Mashbury Church wall, near Chelmsford. Quarry Flint nodule.

Figure 16: Church of St George, Great Bromley. Dressed and knapped blocks of flint.

Figure 17: Church of St Nicholas of Myra, South Ockendon. Knapped flint and Reigate Stone.

Figure 18: Church of St Mary and St Lawrence, Great Waltham. Knapped flintwork.

Chalk (Clunch)

The white chalky limestones of the Upper Cretaceous White Chalk Subgroup are among the most easily recognised building stones employed in Essex. They occur in the northernmost and southernmost parts of the county, around Saffron Walden and Thurrock, respectively. In Essex, chalk also occurs as isolated boulders or cobbles in geologically much younger deposits, including boulder clay. Chalk is a white to very pale grey or pale buff, typically structureless, very fine-grained limestone, which in places forms harder bands and contains fossil bivalves (including oysters, inoceramids) and echinoids, and occasionally crinoids, brachiopods and belemnites. It is less durable than other stones as repeated wetting and drying (coupled with frost action) causes the relatively soft rock to powder and disintegrate into small angular brash. Softer forms of the stone, when used externally, may show concave weathering away from mortar lines.

Chalk is not employed commonly as an external building stone in Essex, but it was used occasionally. At Audley End, Thomas Howard, the 1st Earl of Suffolk, built one of the largest houses in the country in the early 17th century. It was constructed in brick and originally faced with chalk (now part repaired with and/or replaced by Chilmark Stone and Ketton Stone). The Church of St Mary the Virgin at Saffron Walden is built mainly of chalk ashlar.

More usually, chalk is encountered in association with other stone types, particularly Quarry Flint and Quaternary Flint. Examples include the Church of St John the Baptist at Thaxted, All Saints' Church at Great Chesterford and All Saints' Church at Great Braxted. The last exhibits the use of a wide range of materials, including chalk, cement stones, pebbles and cobbles and brick. On the Essex/Suffolk border, flint-built churches (often displaying fine flint decoration or flushwork) with chalk dressings are relatively common. Examples include the Church of St John the Evangelist at Little Leighs and the Church of St Laurence at Ridgewell.

Figure 19: Church of St John the Baptist, Thaxted. Chalk, Quaternary Flint rubble, pebbles and cobbles, with limestone and chalk dressings.

Figure 20: All Saints' Church, Great Chesterford. Flint, pebbles and cobbles, chalk and limestone, with a plinth course in ashlar.

Palaeogene

Thames Group, Harwich Formation

Harwich Cementstone (Harwich Stone)

Harwich Cementstone is a tabular, fine grained to sandy limestone, which is bluish grey to greenish grey when fresh, but weathers to a pale yellow-brown colour. Volcanic ash bands may occur within the limestone, along with veins of green calcite. A shelly marine to brackish water fossil fauna may also be present.

Harwich Cementstone was formerly much used in and around Harwich, but once-cobbled streets featuring the stone in the old town area (King's Quay Street, Church Street) have largely been resurfaced with tarmac or replaced by more modern granite or granodiorite stone setts. Only narrow courses of squared stone setts remain. Harwich Cementstone is present as a very minor constituent in the walls of churches located in the northern coastal parts of the Tendring peninsula, extending westwards from Harwich via Wrabness, Bradfield Heath, Mistley and Manningtree to Lawford.

Figure 21: Church of St Mary the Virgin, Manningtree. Cementstone.

Figure 22: Church of St Mary the Virgin, Lawford. Quaternary flint, Cementstone, Conglomeratic Ironstone and Roman tiles, with limestone dressings.

London Clay Formation

Cementstone (Septaria, Septarian Nodules)

London Clay Formation cementstone is a dark brownish-grey, fine-grained, calcareous mudstone concretion which crops out over much of central Essex (although it is extensively covered by younger superficial deposits).

Cementstone was also obtained from offshore deposits by dredging, and the impressions and borings made by marine organisms (including worms and bivalve shells) that are seen in many church fabric blocks indicate this provenance. Examples of cementstone bored by marine Piddock bivalves are visible in blocks within the walls of the Church of St Mary with St Leonard at Broomfield.

During the late 18th and early 19th centuries, Harwich became the main centre of the Roman cement industry. Roman cement was made from cementstone collected from the foreshore and excavated from the cliffs. Later, when such supplies were exhausted, cementstone was dredged from offshore areas.

Unfortunately, cementstone fractures and weathers relatively easily, and this can sometimes lead to structural failure. Nevertheless, cementstone has been used extensively throughout Essex for building purposes and many churches in the county contain this stone within their wall fabrics. Examples can be seen at Ardleigh, Bradwell-on-Sea, Broomfield, Colchester, Dengie, Heybridge, Goldhanger, Great Bentley, Great Braxted, Great Clacton, Lawford, Maldon, St Osyth, Steeple, West Mersea, Wickham Bishops and Woodham Mortimer. Cement stones were often used in coastal towns and villages. The medieval Church of St John the Baptist at Great Clacton is a good example of the use of cementstone as it is constructed mainly from this stone, in association with mixed Quaternary Flint rubble and pebbles and cobbles.

One of the most impressive uses of cementstone in Essex is the Castle Keep, Colchester. This is the largest surviving Norman keep and it dates from the 11th century. It was built on the former site of the Roman Temple of Claudius. The keep walls are constructed of coursed stone rubble, which includes cementstone and Roman brick robbed from nearby ruins. The ashlar dressings are of Barnack Stone and Caen Stone, in addition to Roman tiles and brick.

Figure 23: Church of St Mary with St Leonard, Broomfield. Cementstone with quartzite pebbles.

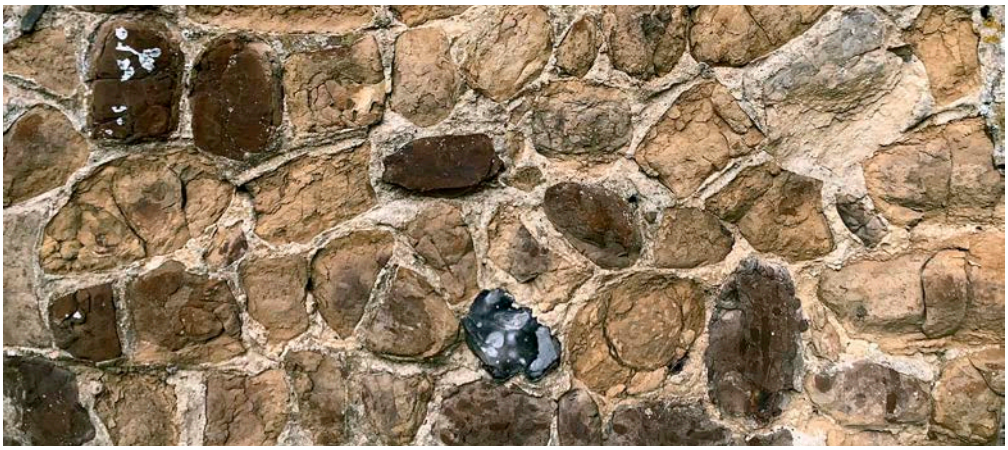


Figure 24: Church of St Peter and St Paul, St Osyth. Cementstone nodules and ferricrete.

Figure 25: Castle Keep, Colchester. Cementstone, Barnack Stone and Caen Stone.

Paloeogene, Neogene and Quaternary

Brecklesham Group and others, Bagshot Formation, Red Crag Formation and others

Ferricrete (Ironstone, Ironpan)

The term ferricrete is applied here to an important group of closely related building stones that formed in geologically recent times as the result of iron-rich groundwaters cementing various sands, gravels and conglomerates. In older literature, ferricrete has typically been used in a very broad sense to encompass a range of ironstone varieties, some of which are highly distinctive.

In Essex, ferricrete appears to be confined to two main geographical areas: the Tendring peninsula in the east (especially the area between Manningtree, Great Bromley and Great Bentley) and southern Essex (within an area encompassing Ingatestone, Basildon, Grays and Brentwood).

Ferricrete is a fine to coarse-grained, deep blackish-brown, or red-brown to orange-brown-coloured, iron-rich sandstone. It tends to be fairly massive and featureless, apart from occasional laminations or lines of small flint or quartzite clasts. Some blocks appear to be quite 'pebbly' and may grade into a Conglomeratic Ironstone variety.

The stratigraphical origins of ferricrete are poorly known. A pebbly, conglomeratic variety of the stone has been seen *in situ* in gravel deposits exposed at Colemans Farm Quarry, Little Braxted. Alternative possible source horizons could lie within other Neogene or Quaternary superficial deposits. Or the stone could derive from iron-rich strata within the Palaeogene Bracklesham Group (Bagshot Formation).

Ferricrete and its varieties are typically hard, durable and tough stones that possess excellent weathering properties. Consequently, ferricrete has been quite widely employed for building purposes wherever it occurs in Essex. Typically, it is used in wall fabrics as roughly tabular to larger-sized blocks, but it can also be found as small, irregular lumps. Slabby forms are very rare, as the stone tends to lack bedding structures. Particularly good examples of the use of ferricrete can be seen at the Church of St Mary at North Stifford, the Church of St Mary at Ardleigh and the Church of St George at Great Bromley, the last of which has a fine late 15th-century tower constructed largely of ferricrete.

Figure 26: Church of St Mary, North Stifford. Ferricrete and Quaternary Flint with Bath Stone and Reigate Stone dressings.

Figure 27: Church of St Mary, North Stifford. Ferricrete and knapped flint with Reigate Stone blocks.

Figure 28: Church of St John the Evangelist, Little Leighs. Sandy ferricrete.

Figure 29: Church of St Mary, Ardleigh. Ferricrete, Quaternary Flint, pebbles and cobbles, cement stone and Roman brick, with limestone and brick dressings.

Figure 30: Church of St Mary, Ardleigh. Blocks of ferricrete and flint flushwork.

Figure 31: Church of St Mary, Great Bentley. Ferricrete.

Figure 32: Church of St Mary, Great Bentley. Ferricrete.

Bracklesham Group, Bagshot Formation

Cinderstone

Cinderstone is a dark-coloured variety of ferricrete, typically appearing blackish-purple and massive in form. It is generally a finer grained stone than Conglomeratic Ironstone, although small, scattered flint clasts or pebbles may be present. Cinderstone typically exhibits closely spaced, irregular cavities of 5 to 15m in size that have near-black linings of iron oxide-cemented coarse silt or sand. The weathered surfaces of blocks often display a blackish iron-oxide 'sheen'.

Particularly fine examples of Cinderstone (and Cinderstone) blocks can be seen in the walls of the church in Great Bentley (Church of St Mary).

Figure 33: Church of St Mary the Virgin, Manningtree. Cinderstone.

Figure 34: Church of St Edmund and St Mary, Ingatestone. Cinderstone.

Crag Group, Red Crag Formation

Conglomeratic Ironstone (Conglomerate)

Conglomeratic Ironstone is the name given here to a very distinctive conglomeratic variety of ferricrete. The main rock type seen is a clast-supported conglomerate, comprising a dark purple-black-coloured, coarse-grained, iron-rich matrix, in which pebbles of orange-brown or blackish Quaternary Flint are set. These pebbles are usually well rounded and vary in diameter from 20 to around 70mm. Typically, smaller sub-angular clasts or flakes of Quaternary Flint are also present, sandwiched between larger rounded pebbles. The clasts show no obvious preferred orientation. Some blocks of Conglomeratic Ironstone lack the larger rounded pebbles and instead contain smaller sub-angular clasts (up to 20mm in diameter) of flint, sandstone and (occasionally) chert, set within a purple-black, iron-rich matrix. These blocks may be classed as matrix-supported breccio-conglomerates. Intermediate varieties of Conglomeratic Ironstone also occur, sometimes within the same block.

Superficially, some blocks of Conglomeratic Ironstone resemble Hertfordshire Puddingstone, but they are readily distinguished by their overall darker colour and iron-rich matrix. These features contrast strongly with the much paler Hertfordshire Puddingstone, with its light grey, siliceous matrix.

Conglomeratic Ironstone is typically encountered as isolated, irregular blocks within the stone matrix of church walls, and it is often associated with Quaternary Flint. Occasionally, it represents one of the main constituents of a building and it may dominate the stone fabric of sections of individual walls. Particularly good examples can be seen in the walls of churches in North Stifford (Church of St Mary), Ingatestone (Church of SS Edmund and Mary), Great Bentley (Church of St Mary the Virgin), Fryerning (Church of St Mary the Virgin) and Mountnessing (Church of St Giles).

Figure 35: Church of St Mary, North Stifford. Conglomeratic Ironstone and Cinderstone.

Figure 36: Church of St Edmund and St Mary, Ingatestone. Conglomeratic Ironstone and Cinderstone.

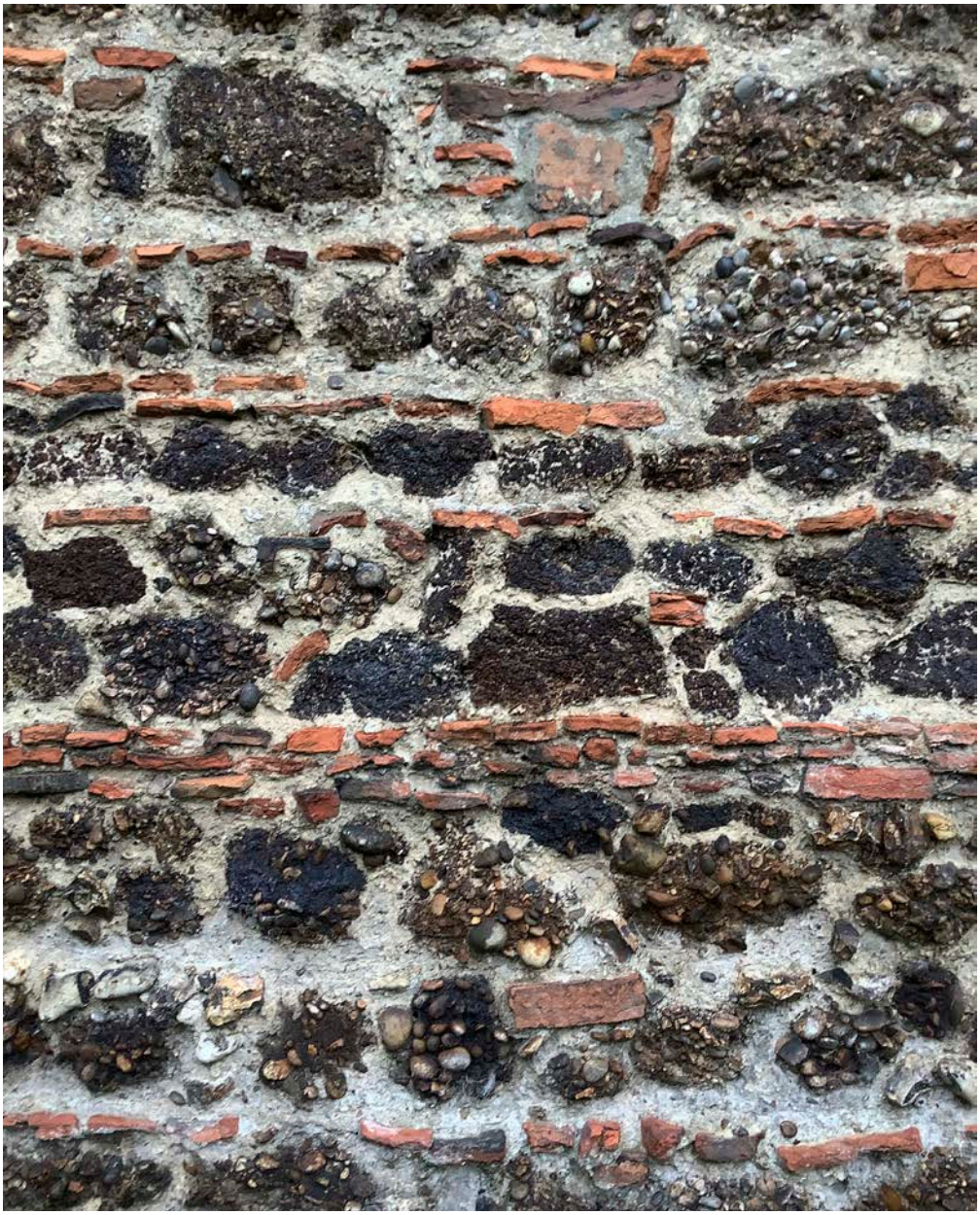


Figure 37: Church of St Edmund and St Mary, Ingatestone. Conglomeratic Ironstone.

Figure 38: Church of St Mary the Virgin, Fryerning. Conglomeratic Ironstone, Roman brick and flint rubble, with limestone, chalk and Roman brick dressings.

Quaternary

Various groups, various formations

Hertfordshire Puddingstone

Hertfordshire Puddingstone is one of the most distinctive stone types encountered in Essex. It is thought to originate from the Upnor Formation in Hertfordshire and to have been transported into Essex by the early Thames and deposited within the river gravel deposits. The puddingstone is a conglomerate, containing sub-rounded pebbles of flint, which mainly exhibit grey interiors but may be stained by various iron compounds to produce attractive hues of red, orange or (occasionally) green. The size of the pebbles varies considerably, even within a single block, but they typically range from 10 to 100mm. However, much larger cobbles sometimes occur. The pebbles are cemented by relatively uniform pale grey or buff quartz. Overall, Hertfordshire Puddingstone is a hard, coherent and durable rock that tends to break in a regular, planar manner both around and through pebbles. Synthetic concrete may resemble Hertfordshire Puddingstone, but it fractures unevenly. Conglomeratic Ironstone is much darker coloured and has an iron-rich cement.

Hertfordshire Puddingstone is a relatively uncommon building stone in Essex and has a scattered distribution. Where encountered, it usually occurs as isolated blocks within early church walls or as large boulders in grass verges, churchyards, or as markers at road junctions or farm entrances. Examples can be seen in the Church of St Mary at Wendens Ambo (some blocks of puddingstone here have been reddened by fire), the Church of St Mary with St Leonard at Broomfield, St Helen's Chapel at Wicken Bonhunt, All Saints' Church at Doddinghurst and the churchyard wall at Roxwell, near Chelmsford.

Figure 39: Former Chapel of St Helen, Wicken Bonhunt. Sarsen stone with Hertfordshire Puddingstone, pebbles and cobbles.

Figure 40: Church of All Saints, Doddinghurst. Hertfordshire Puddingstone.

Figure 41: Church of St Mary the Virgin, Great Leighs. Hertfordshire Puddingstone and flint.

Sarsen Stone (Silcrete, Sarcen)

Sarsen stones are loose blocks of hard quartzitic sandstone, which typically occur as rounded or elongate boulders but are sometimes encountered as metre-scale slabs. They are often found at the roadside or by the sides of fields in many parts of north and central Essex, having usually been 'placed' there by farmers who found them in the fields (where they pose a risk to agricultural machinery). Sarsen stones are pale grey to pale brown in colour, becoming distinctly creamy buff or deep greyish-brown when weathered. They possess a very fine-grained 'sugary' texture, comprising sub-rounded quartz grains set within a silica matrix, which is visible on fractured surfaces. Sarsen stones are very hard and resistant to weathering. Their surfaces are often smooth and may occasionally show poorly defined bedding structures. Some Sarsen stones, particularly those in the Thurrock area, are relatively 'unworn' and exhibit remarkable and distinctive mammillated surfaces, comprising undulations, rounded mounds and other small protrusions.

Sarsen stones are fairly common in northern Essex, particularly in the Cam, Stort and Stour Valleys. They are also concentrated around Chipping Ongar and Chelmsford. Sarsen stones have had several historic uses in Essex, including as way markers and gravestones. Many north Essex churches use Sarsen stones as foundation stones (for example, the former St Helen's Chapel at Wicken Bonhunt). Sarsen Stone was also used as an occasional walling stone, as in the Church of St Peter at Boxted and the Church of St Thomas of Canterbury at Brentwood.

Figure 42: Former Chapel of St Helen, Wicken Bonhunt. Sarsen stone footing with possible Barnack Stone quoins.

Figure 43: Church of All Saints, Doddinghurst. Sarsen stone, pebbles, cobbles and chalk.

Figure 44: Beaumont Quay, Hamford Water. Reigate Stone and Sarsen stone.

Figure 45: Church of St Katharine, Little Bardfield. Sarsen stone.

Quaternary Flint (Field Flint, River Terrace Gravel Flint)

Quaternary Flint is the most extensively and commonly used building stone in Essex. It typically occurs as irregularly shaped nodules that are found lying on the surfaces of fields or as pebbles within fluvio-glacial and river terrace gravels and sands (notably the Kesgrave Catchment Subgroup, previously called the Kesgrave Sands and Gravels). The size of the nodules typically ranges from 100 to 300mm. The colour is variable: less weathered flint nodules or pebbles have a cream outer cortex with darker coloured (greyish) interior; weathered flints, or those that have lain in soil or superficial deposits for a long period of time, may be variously discoloured or bleached, and often have brown stained interiors due to the precipitation of iron hydroxides from percolating ferruginous waters. Quaternary Flint breaks with a conchoidal fracture and some pebbles display 'chatter marks' (tiny curved pits, indentations or cracks) on highly weathered surfaces. Other pebbles may be 'hackly' (lacking any conchoidal fracture) and coloured red, indicating they have been exposed to fire. This weathered appearance helps distinguish field flint from the much fresher looking Quarry Flint.

A combination of hardness, durability and resistance to weathering has resulted in Quaternary Flint being much used as a building stone wherever deposits are (or were) present in Essex. It was mainly employed as nodules or pebbles laid randomly or roughly to course, but occasionally as knapped, faced trimmed or cleaved faced stone in random or decorative arrangements. The stone was used very extensively and can be seen in many churches, buildings and walls in towns and villages across the county. A particularly fine example of knapped Quaternary Flint can be seen at the Church of All Saints at Brightlingsea.

Figure 46: Church of St Germanus, Faulkbourne. Tufa, Kentish Ragstone, Quaternary Flint and vein quartz pebbles and cobbles, with Barnack stone dressings.

Figure 47: Church of All Saints, Brightlingsea. Knapped Quaternary Flint with Bath Stone dressings, and possibly some Lincolnshire Limestone.

Pebbles and Cobbles (Fieldstone)

The Quaternary fluvio-glacial deposits of Essex (notably those belonging to the Kesgrave Catchment Subgroup) encompass a diverse range of poorly sorted, relatively soft and unconsolidated sediments that have been exploited (by means of pits and larger excavations) for construction materials. The harder pebbles and cobbles yielded as a by-product of this activity served as an important and convenient source of stone for local buildings and walls. Pebbles and cobbles were also cleared from nearby field surfaces and used as building materials.

The pebbles and cobbles vary considerably in composition. They include chert (orange-brown to pale brown), vein quartz (white or iron-stained pink to brown and sometimes exhibiting very small quartz crystals), quartzite (often liver or brownish-coloured Bunter pebbles from the Triassic Chester Formation of the Midlands), chalk (usually from glacial till deposits), various limestones (including Jurassic and Carboniferous limestones), Carboniferous sandstones, igneous and metamorphic rocks (for example, dolerite, granite or Cornish Rock, very tough and compact, veined or brecciated) and, very occasionally, red and yellow jasper or cream-coloured chalcedony.

Such pebbles and cobbles have long been used as a building material throughout Essex, especially in the construction of church walls. Many Saxon and early medieval churches make use of pebbles and cobbles, as well as recycled Roman brick and tile.

Particularly fine examples of pebbles and cobbles can be seen in the following: the Church of St Mary at Little Baddow (containing abundant brown-buff-coloured Bunter quartzite pebbles), All Saints' Church at Great Braxted, Chelmsford Cathedral (includes split quartzite, Quaternary Flint and Quarry Flint), St Leonard's Hall next to the Church of St Mary with St Leonard at Broomfield, the Church of St Mary the Virgin at Broomfield (coursed whole flint with cementstone and Conglomeratic Ironstone), All Saints' Church at Great Chesterford, the Church of St Thomas of Canterbury at Brentwood (employing a great variety of stones, including Quaternary Flint, Sarsen stone, chert, quartzite and vein quartz pebbles) and the Church of St Mary at Ardleigh (with ferricrete, cementstone and Roman brick).

Figure 48: Church of All Saints, Great Braxted. Chalk, flint, Cementstone, pebbles, cobbles and brick.

Figure 49: Church of St Mary the Virgin, Little Baddow. Bunter quartzite pebble.

Figure 50: Church of All Saints, Great Braxted. Quartzite pebbles.

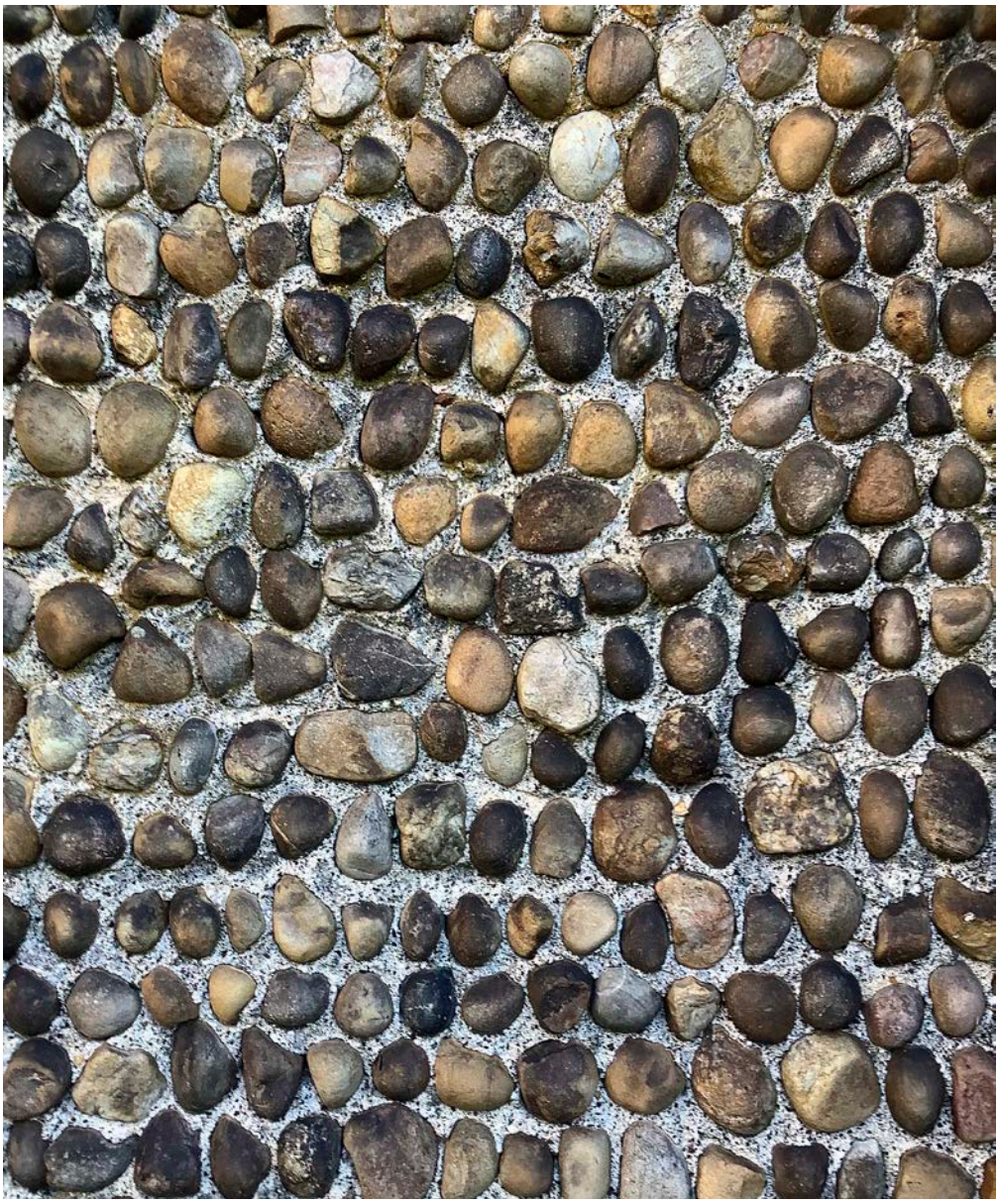


Figure 51: Cathedral wall, Chelmsford. Split quartzite pebbles.

Tufa

Tufa is a whitish or pale grey-coloured limestone formed by the precipitation of calcium carbonate (lime) in or adjacent to springs issuing from calcareous rocks, such as chalk or limestone. It is often highly porous and open textured, with up to 50 per cent void or irregular cavity space. Blocks may be 'fibrous' and contain the impressions of vegetation remains. They sometimes exhibit faint traces of banding. When freshly quarried, tufa is soft and crumbly and it is easily cut into blocks suitable for use as ashlar. However, upon exposure to air, it hardens to become a useful, more general building stone.

Tufa was quarried at several sites near Braintree and Brentwood, but its very localised occurrence has resulted in only limited and sporadic use, mainly as a rubblestone in medieval church walls. It was used sparingly in St Germanus' Church at Faulkbourne, All Saints' Church at Vange and the Church of SS Peter and Paul at Stondon Massey. Tufa was also notably used as facings for the Roman Balkerne Gate in Colchester.

Figure 52: Church of St Mary the Virgin, Little Baddow. Tufa.

Figure 53: St Germanus' Church, Faulkbourne. Tufa.

4 Examples of Imported Building Stones

Although the Lower Cretaceous to Quaternary succession of Essex has yielded a variety of indigenous building stones, in some areas these are in limited supply and extensive use has been made of imported stones. These have been sourced from other parts of England and, indeed, further afield.

Sedimentary stone types

Upper Carboniferous

Millstone Grit or Pennine Coal Measures Group

York Stone (Yorkshire Flags), West and South Yorkshire

Buff to pale grey or greenish-grey, typically fine-grained sandstones, often micaceous and laminated, but occasionally show small-scale cross-bedding features. York Stone usually weathers evenly but may separate along mica-rich horizons. It is little used as a building stone in Essex, but is mainly employed as flagstones, paving stones or plinths.

Permo-Triassic

Various formation, various groups

Permo-Triassic Red Sandstone, possibly from the Midlands

Pale red to red-brown, fine to medium-grained sandstones that often display expressions of cross-bedding and lamination. The individual sandstone types and sources of these New Red Sandstones are often impossible to determine without documentary or petrological evidence. These sandstones have been employed only occasionally in Essex, typically as facing or decorative stones or as dressings.

Figure 54: Church of St Michael, Thorpe-le-Soken. Permo-Triassic red sandstone.

Middle Jurassic

Inferior Oolite Group, Lincolnshire Limestone Formation

Lincolnshire Limestones (including Ketton Stone), Lincolnshire, Northamptonshire, Rutland

There are several varieties of Lincolnshire Limestone (including Ketton Stone, Weldon Stone and King's Cliffe Stone) used in Essex. They cannot reliably be distinguished.

Limestone incorporates a continuum of pale cream to pale grey-coloured limestones, which weather to shades of buff-yellow; the stones are variably ooidal and/or bioclastic. Cross-bedding features may or may not be displayed, and the stone is variably porous. Lincolnshire Limestone has been employed throughout Essex, primarily as dressings and for decorative work in ecclesiastical buildings.

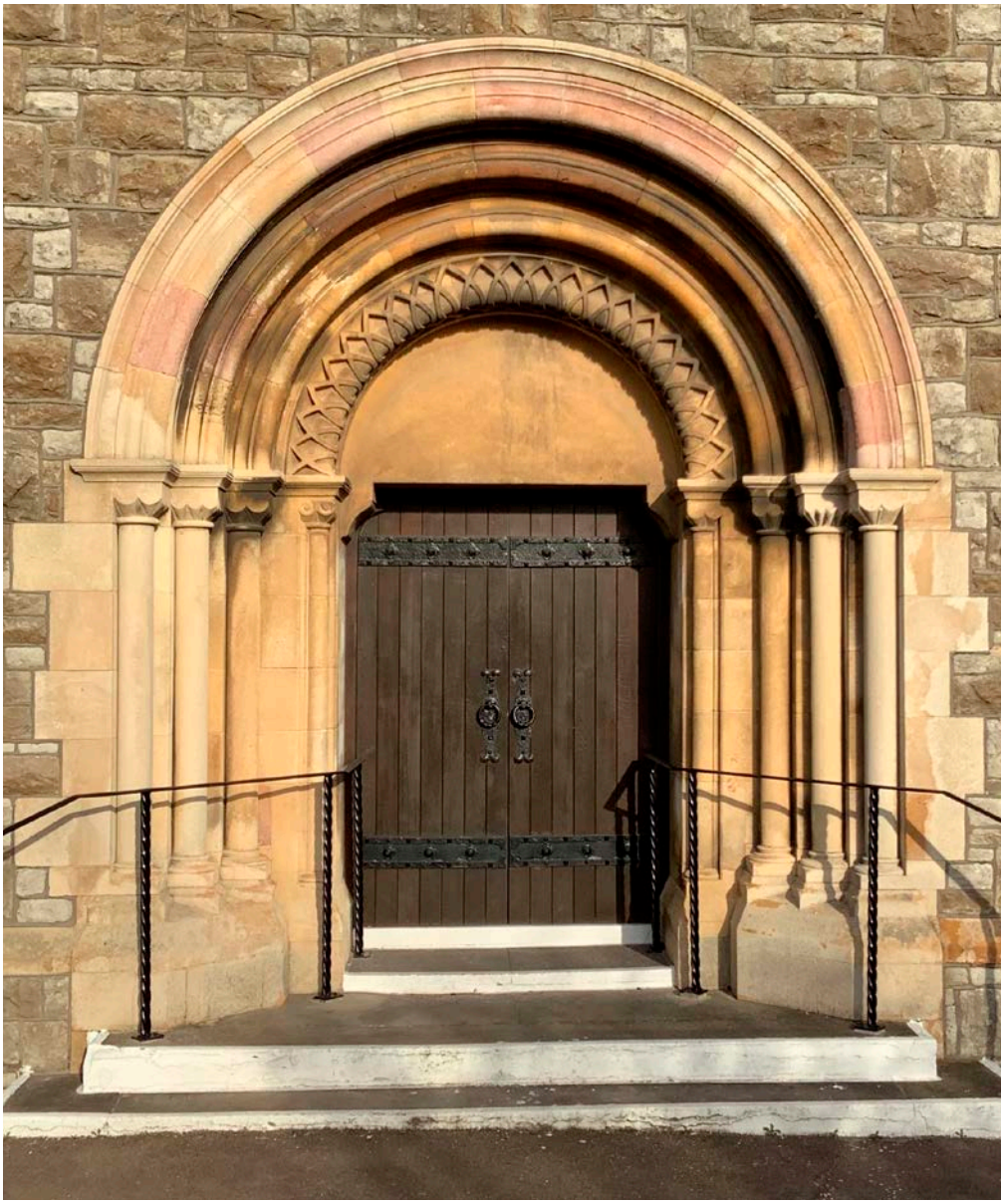


Figure 55: Church of Our Lady of Light and St Osyth, Clacton-on-Sea. Ketton Stone-type dressings.

Ancaster Stone, Ancaster, Lincolnshire

A medium to coarse-grained, creamy-white to pale yellow (occasionally weathering reddish), ooidal and bioclastic limestone. It exhibits cross-bedding structures that give rise to a distinctive 'streaky bacon-like' appearance. In Essex, Ancaster Stone has been seldom used and it is mainly encountered in the ornate front portals of commercial buildings or as dressings in churches and chapels.

Figure 56: Church of St John, Highwoods, Colchester. Red and gault brick with limestone dressings, including Ancaster Stone.

Barnack Stone, Cambridgeshire

Barnack Stone is an atypically hard, pale buff-coloured, medium to coarse-grained, shelly ooidal limestone cemented with sparry calcite. The stone usually displays cross-bedding, and differential weathering of its constituent grains (ooids of varying sizes and fossil shell debris up to 5mm in size) imparts a rough feel to exposed surfaces. In Essex, the stone was mainly employed for dressings in churches and other ecclesiastical buildings that pre-date the mid-15th century. Barnack Stone is seen in younger structures, however, and such stone was clearly derived from buildings that were demolished at the time of the Dissolution.

Figure 57: Bourne Mill, Colchester. Barnack Stone.

Clipsham Stone, Rutland/Lincolnshire

A rather poorly sorted, medium to coarse-grained, ooidial, peloidal and bioclastic limestone. It is usually pale cream or greyish buff in colour but features sporadic blue patches that weather greyish buff over time. A high-quality, relatively fine-grained, silver white-coloured variety is used for internal features such as fireplaces. Blue-hearted blocks weather over time to the more typical greyish-buff colour. Occasionally encountered in Essex, Clipsham Stone has been used for the dressings of churches and other ecclesiastical and civic buildings, as well as for memorials.

Figure 58: War memorial, Brentwood. Clipsham Stone.

Great Oolite Group,Chalfield Oolite Formation

Bath Stone, Bath, north east Somerset and possibly Corsham area, Wiltshire

A cream to buff-yellow, ooidal and variably bioclastic limestone (freestone). Bath Stone is used extensively throughout Essex, especially in Victorian new-build and church refurbishment schemes, as ashlar and window and door mouldings, in particular.

Figure 59: Albert Hall building, High Street, Colchester. Bath Stone ashlar.

Calcaire de Caen Formation

Caen Stone, Normandy, France

An off-white to pale creamy yellow-coloured limestone with a fine-grained texture and few large bioclasts. It may exhibit spalling, and individual blocks of Caen Stone may also show uneven weathering. It has been employed occasionally in Essex, mainly in ecclesiastical buildings or fortifications dating to Norman times.

Figure 60: Church of St Mary, Arkesden. Caen Stone dressings.

Upper Jurassic

Portland Group, Portland Stone Formation

Portland Stone, Isle of Portland, Dorset

A near-white or very pale coloured limestone that (in its basement bed guise at least) is typically a fine and even-grained freestone. It has seen widespread use across Essex, especially in urban areas in carved form. It has

been utilised for monuments, war memorials, gravestones, fountains and columns. Portland Stone is also employed as a high-quality walling stone, notably in civic, administrative and financial buildings.

Figure 61: Town hall, Colchester. Red brick and Portland Stone.

Chilmark Stone, Wiltshire

A pale cream or greenish grey-coloured, sandy limestone or very fine to fine-grained calcareous sandstone, which contains greater or lesser amounts of glauconite grains. Chilmark Stone is worked for building stone in the Vale of Wardour, Wiltshire. It is quite distinctive and different in character to the similarly aged, white-coloured, ooidal Portland Stone.

Figure 62: Audley End House, near Saffron Walden. Chilmark Stone ashlar.

Lower Cretaceous

Purbeck Group

Purbeck Limestone, Isle of Purbeck, Dorset

A dark grey-green, shelly limestone, often containing pale coloured sections of fossil oysters and other shells. It is mainly used for internal ornamental work but has been employed occasionally for external paving and walling.

Figure 63: Church of St Mary, Stapleford Tawney. Quaternary Flint and Purbeck Limestone.

Lower Greensand Group, Hythe Formation

Kentish Ragstone, Weald of Kent

A medium to coarse-grained, pale greenish-grey or pale brown limestone that contains greater or lesser amounts of quartz, glauconite and fossil shell debris. Some beds and blocks are chert rich. Kentish Ragstone has seen much use across Essex, usually for the walling of ecclesiastical and other buildings. It is typically employed as dressed (often rock-faced) tabular blocks.

Figure 64: Hadleigh Castle, near Benfleet. Kentish Ragstone.

Lower Greensand Group, Sandgate Formation

Bargate Stone, Surrey

Usually a hard, medium-grained, rich honey brown-coloured, calcareous sandstone. However, varieties include dark fawn-brown or grey-green, glauconitic, often flaggy, calcareous sandstones and a pale brown, coarse-grained gritstone. Bargate Stone sometimes also exhibits cross-bedding and/or honeycomb weathering textures. It is used occasionally in Essex, as regular rectangular blocks.

Figure 65: Church of All Saints, Chigwell Row. Bargate Stone with Bath Stone dressings.

Upper Greensand Formation, Selborne Group

Reigate Stone, Surrey

A massive, pale grey to off-white calcareous siltstone that weathers to a pleasant pale buff, grey or cream colour. It is rarely fossiliferous. From a distance, weathered Reigate Stone can resemble chalk, but the latter powders easily when scratched. It also lacks the speckled effect caused by mica flakes that is seen on some surfaces of Reigate Stone blocks. Reigate Stone is more durable than chalk, especially the forms that contain more calcite cement. It is employed fairly commonly in Essex, particularly for high-status ecclesiastical buildings and fortifications.

Figure 66: Waltham Abbey, Epping Forest. Reigate Stone.

Igneous and metamorphic stone types

Neoproterozoic to Early Permian

Granite, various sources including Cornwall, Devon and Scotland

A coarse-grained igneous rock, usually pale grey or pink in colour, comprising grey quartz and white or pink feldspar crystals. The latter can exist as distinctly larger, well-formed crystals (termed phenocrysts). Lesser amounts of iron- and magnesium-bearing minerals and mica are also usually present. Granite is very durable and various types have been employed in Essex. It has been used decoratively in finely dressed and polished guises, or as a facing stone on buildings such as banks or offices. Granite has also been used in the construction of bridges and for paving setts, kerbs and memorial stones.

Figure 67: Larkin's horse trough, High Street, Shenfield Common. Cornish Granite with a Peterhead Granite bowl.

Figure 68: William Hunter monument, Brentwood. Peterhead Granite.

Ordovician

Mountsorrel Complex

Granodiorite, Mountsorrel, Leicestershire

Variously coloured, medium to coarse-grained igneous rocks, comprising a network of interlocking crystals of quartz (typically pale grey) and feldspar (often white or pinkish-red), together with greater or lesser amounts of ferromagnesian minerals (black or dark green). A range of granodiorites and diorites from several sources, including the Mountsorrel Complex, has been employed in Essex for various purposes, including ornamental stonework. These stones are durable and hard wearing and have commonly been used for paving setts and kerbs as a result.

Figure 69: Maidenburgh Street, Colchester. Granodiorite and granite.

Various ages, usually Neoproterozoic to Early Permian

Ballast

A wide variety of pebbles and cobbles are seen in the fabrics of some buildings (notably churches and inns) and in walls. The range of different stones typically includes igneous granites, syenites, dolerites, porphyries and lavas, and metamorphic amphibolites, gneisses (pegmatitic, banded, augen and garnet-bearing), schists and phyllites. The proximity of these stones to coastal areas indicates they have been sourced from off-loaded ships' ballast.

Figure 70: Roadside wall, High Street, Mistley. Igneous and metamorphic rocks, some from the Larvik area of Norway.

Figure 71: Church of St Katharine, Little Bardfield. Dolerite pebble.

Figure 72: Roadside wall, near Mistley Quay. Rhomb porphyry ballast cobble.

Roofing slates including Welsh Slate, Westmorland Green Slate, Delabole Slate

Several different types of metamorphic slate have been imported into Essex and used for roofing purposes. Welsh Slate, for example, was employed in many of the county's villages, towns and cities; good examples can be seen in Harwich. Other types of metamorphic roofing slate used in Essex include Westmorland Slate from Cumbria and Delabole Slate from Cornwall.

Figure 73: The Homestead, Frinton-on Sea. Bath Stone dressings and a Westmorland Slate roof.

Figure 74: Former almshouses, St Michael's Road, Braintree. Northwick brick with Portland Stone string courses and dressings, and a Delabole Slate roof.

5 Further Reading

The Further Reading, Online Resources and Contacts guide provides general references on:

- Geology, building stones and mineral planning
- Historic building conservation, architecture and landscape.

There is also a separate glossary of geological terms.

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7 Acknowledgements

The Building Stones of England series was developed by Geckoella Ltd (Andy King), the British Geological Survey (Don Cameron, Graham Lott, and Stephen Parry), and Historic England (Clara Willett).

Historic England and the British Geological Survey developed the Building Stone Database for England with advice from many local geologists and historic building experts and all these individuals are thanked for their contributions.

For this guide, Historic England would like to also thank Essex Rock & Mineral Society and Gerald Lucy, Ian and Ros Mercer; Domenico D'Alessandro and Malcolm Starr (Historic England).

The Department for Levelling Up, Housing and Communities supported the development of the Building Stones of England database project.

Figures

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Product code: HEBSE15
Publication date: October 2020
Reissue date: May 2023
Design: Historic England