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**ABERCROMBIE, Charles** (1750–1817), eminent Scottish road surveyor and engineer, was born in 1750 at St. Cyrus, Kincardineshire, where his father, James, was gardener or factor to the Laird of Morphie. Abercrombie is thought to have been educated at Montrose burgh school but nothing is known of his early life and work. His earliest extant plan is of the Mans [*sic*] of Kinnalty (1771). Improvement of Scotland's main roads began about 1750 and gathered momentum from the late 1780s, by which time he was playing a leading role in their planning and construction. Unusually for the time, his road layouts were effectively engineered to lines and levels which facilitated horse traction, similar to the practice later institutionalised by Thomas Telford (q.v.) which formed the basis of modern design.

Abercrombie adopted a robust flexible form of road construction; for example, in 1813 for part of the Glasgow to Carlisle Road, he proposed an 18 ft. wide carriageway consisting of a 16-in. layer of broken stone, with the hardest (whinstone) in the top 8 in., and side drainage. This was a stronger form of construction than that subsequently adopted by John Loudon McAdam (q.v.) in his widely promoted and implemented system of road-making from 1816.

Although Abercrombie planned much of the present-day Scottish road network his achievements are less well-known than those of Telford and McAdam, probably because he generally worked on his own. Telford was particularly appreciative of his work and mentioned it in several reports. For example, in one of 26 March 1824 relating to the Maybole to Girvan eastern line of the Glasgow to Portpatrick road, he commented that the road had been executed 'according to the surveys of that excellent road surveyor, the late Mr. Abercrombie'.

An indication of the immense scale of Abercrombie's work is provided by Sir John Sinclair's comment in his *General Report on the Agricultural State ... of Scotland* (1814), that the 'art of reducing [road] ascents and descents by a well-directed line has been brought to its utmost perfection by Mr. Charles Abercrombie, who has lined out above 10,000 [*sic*] miles of road in Scotland, besides what he has executed in Ireland, with uniform success, even in the most difficult districts'.

Abercrombie's early work included the roads radiating from Perth. The prominent Perthshire road trustee, Sir Patrick Murray, stated in 1814 that he 'never knew an instance where any material deviation took place from lines of road laid down by Abercrombie, when such deviations were not found to be disadvantageous and when they were not afterwards regretted or required to be altered'.

Further north, Abercrombie surveyed and engineered many roads in and around Dundee and Aberdeen. At Aberdeen in 1799 he was described in minutes as an 'engineer of great eminence' and from 1800 to 1807 his work included planning and constructing the main approach from the south and the city's principal thoroughfare, Union Street. Contemporaneously he planned a succession of road improvements in Ayrshire (1802–1807) centred on Girvan. In 1807 he surveyed an alternative line of road from Tarbet (Loch Lomond) to Cairndow (Loch Fyne). In the central belt of Scotland Abercrombie surveyed roads in the Edinburgh area; for example, the Newmills Bridge approaches at Dalkeith on the Edinburgh to Newcastle road in 1814 and much of the east coast main road from Edinburgh to Berwick-on-Tweed. He worked in and around Glasgow and on the Glasgow to Carlisle road as early as 1798 and on another section of this road in 1813. He also put forward proposals for improving some 'military roads'; for example, in 1809, over the 'Rest and be Thankful' hill at the head of Glencroe on the Dumbarton to Inveraray road. Abercrombie also prepared a report with plans for at least two harbours: Montrose, in June 1806, estimating the cost of its improvement at £8,223, and Dunure in 1811.

Abercrombie eventually retired to Doonfoot, on the coast near Ayr, where he built the house that was known for over a century as 'Abercrombie House'. Prior to its completion he lived in a herring-boat with a wooden house built on its deck, which he used to sail to locations on the west coast where surveying was required. He died on 13 August 1817 and was buried in Ayr Parish Churchyard where a stone monument still stands in his memory. He had a brother, James, who became a surveyor/engineer in England on harbour and bridge construction, and worked for Rennie on Waterloo Bridge, London (1810–1817), and afterwards as a surveyor at Southwark.

R. A. PAXTON

[Various Scottish Turnpike Trust Minutes; Plans (5001, 658/4, 22477, 6694, 6782, 21854, 21856, 21857, 2028, 2739), SRO; Business records of Robert Stevenson & Sons. MS. Acc. 10706, 128, 363–369, NLS; Ms. S. A. Robertson (n.d.) *The Roads and Bridges of Scotland*, chap. 8, Charles Abercrombie (1750–1817) (now in the papers of the late Prof. Percy Johnson-Marshall, Edinburgh University); T. Telford (1824) Report on roads from Glasgow to Port Patrick; H. Hamilton (1963) *An Economic History of Scotland in the Eighteenth Century* 27; R. A. Paxton (1998) *Road and Bridge Making on Main Routes in and around Dalkeith 1750–1850*]

#### Publications

1813. Report of Mr. Charles Abercrombie. In: *Reports Respecting a New Line of Road from Hamilton to Elvanfoot*

**Works**

(Note: Abercrombie surveyed more than 1,000 miles of roads, and surveys survive for Aberdeenshire, Argyll, Angus, Ayr, Berwick, Caithness, Fife, Lanarkshire, Midlothian, Perthshire, Renfrewshire and Sutherland; a selection of works carried out to his recommendations follows)

1787–1794. Perth to Crieff (30 ft. broad (between fences?), maximum gradient 1 in 50, replacing 1 in 10 over the brae of Foulis), on to Comrie, 1812 (Abercrombie's proposed maximum gradients of 1 in 30 were, according to Trust chairman Sir Patrick Murray not implemented in places with very injurious effects)

1789–1808. Perth to Forfar (in four sections)

1790–1791. Perth to Invergowrie

1793–1796. Perth to Dunblane, and Blairgowrie

1798 and 1813. Glasgow–Carlisle Road (parts)

1800–1807. Aberdeen, Union Street and southern approaches

1800–1811. Perth (towards Stirling)–Auchterarder–Greenloaning

1802–1804. New Inn (from Burntisland) to Newport via Rathillet

1802–1807. Roads in Ayrshire in Girvan area

1803–1820. Milnathort via Auchtermuchty to Cupar and St. Andrews

1805. Cranstoun Bridge, Midlothian

1808–1818. Bridge of Earn to Glenfarg, Milnathort to Cowdenbeath, and towards N. Queensferry (at Glenfarg the gradient was improved from 1 in 10 to 1 in 55)

1814. Dalkeith area, Edinburgh–Newcastle Road

1815. Glendevon to Gleneagles (nearly 600 ft. of rises and falls were eliminated and the gradient reduced to one seldom exceeding 1 in 40)

**ABERNETHY, George** (fl. 1819–1853), mechanical engineer, is first known as manager of a small works in Aberdeen. In 1823 he went to Wales to manage the Dowlais ironworks for John Guest and in 1827 he took over an iron foundry in Southwark. While living at 10 Hermitage Street, London, he was elected a Member of the Institution of Civil Engineers in 1828, and remained a member until 1853 when he resigned. His proposal form was signed by Thomas Rhodes (q.v.) and others involved in the construction of St. Katharine's Dock and he is believed to have become involved in dock work at that time. He then acted as assistant engineer with Rhodes on the timber pier designed by Telford at Herne Bay in 1831. He must have displayed some talent as in 1833 Thomas Telford (q.v.) sought his advice in relation to an opinion he had been asked to give on Seaham Harbour. Abernethy then acted as resident engineer under Henry Robinson Palmer (q.v.) at London Docks.

He had two sons, George and James, the latter becoming President of the Institution of Civil Engineers in 1880.

MIKE CHRIMES

[T. Telford (1833) *Diary*. NLS; *Membership Records*. ICE]

**ABRAHAM, Robert** (1774–1850). The son of a builder, Abraham trained and worked as a London building surveyor until in middle age he established a successful architectural practice (Colvin lists works between 1819 and 1842). His contribution to engineering was the concrete raft foundation for the buildings of the Westminster New Bridewell prison in Tothill Fields close to the Thames, and especially the process of groundwater lowering introduced by him (in 1830) on this job. The raft covered an area of rather more than 5 acres. It was 7 ft. thick, increased to 9 ft. under the boundary walls at a depth of 12 ft. below high tide level, and contained 60,000 cu. yd. of concrete.

Concrete raft foundations had been used earlier, in similar situations on Thames alluvium, by Sir Robert Smirke (q.v.) at Millbank Penitentiary (1817) and the Custom House (1825). Abraham's innovation was to lower the groundwater before excavation to a level below the base of the raft and keep it lowered during construction until the concrete had hardened. By this procedure, described by Pasley (1838) as 'perfectly original', excavation and concreting could be carried out in the dry.

Abraham's specification required the contractor to sink a 6 ft. diameter well near the middle of the area, some 300 ft. from the boundary walls, to a depth of 20 ft. below high tide level (into gravel) from which pumps operated by an 8 hp steam engine would lower groundwater to a depth of a few feet below the base of the raft. Excavation could then proceed and, when completed, concrete was pitched in from a height of 9 ft. and immediately trodden down in 9-in. to 12-in. layers. The concrete specification, an advance on previous practice, called for 1 part of Dorking or Merstham lime, 2 parts of sand and 6 of gravel (by volume). These to be well mixed, then 4 cu. ft. of water added for every 3 cu. ft. of lime, and then mixed again. Dorking lime contains about 8% of clay and when burnt produces hydraulic lime capable of setting under water.

Pumping, excavation and concreting were carried out during 1830–1831 with complete success at a cost of £30,000. The buildings were completed in 1834.

Abraham passed on his extensive knowledge of building practice to a number of pupils. They presented a gold box to him on retirement in 1842. He died on 11 December 1850 and was buried in Hampstead churchyard.

A. W. SKEMPTON

[George Godwin (1836) On the nature and properties of concrete, *Trans Inst British Architects*, 1, 1–37; Plan of Westminster New Bridewell, RIBA Library; Charles Pasley (1838) *Observations on Limes, Calcareous Cements and Concrete*; Colvin]