



5 CONSTRUCTION DETAILS

5.1 Addison Houses

5.1.1 Introduction

The Building Research Establishment (BRE) were unable to provide any information concerning this particular system type, although it is believed the properties in the South Cambridgeshire District were erected in 1921-1922. Despite extensive experience of non-traditional housing systems, this is not a construction type previously known to MDAL.

5.1.2 Foundations

The substructure consists of concrete strip foundations supporting a course of blocks laid flat, similar to modern day trench blocks.

5.1.3 External Walls

External walls are of cavity wall construction, comprising two leaves of 4" concrete blockwork, laid stretcher bond, separated by a 2" uninsulated cavity. They are lined internally with fibreboard.

Brickwork quoin coursing is incorporated to the corners of the building and an 18" wide brickwork pier is built either side of the front door opening.

A 'band' course, formed by a projecting course of blockwork, is introduced at first floor level, with pre-cast concrete lintels incorporated over window and door openings.

5.1.4 Floors

The ground floor is of solid concrete construction, whilst the first floor is of timber construction.

5.1.5 Roof

The roof is a traditional timber rafter/purlin structure, with a king post truss arrangement. The roof is clad with interlocking tiles on felt and battens.

5.1.6 Other

The party wall is believed to be of cavity wall construction similar to the external walls. The chimneys and internal partitions are also built in blockwork.

Ceilings are formed with fibreboard.



5.2 Airey Houses

5.2.1 Introduction

The design was developed by Leeds-based builder Sir Edwin Airey in the aftermath of the Second World War, and built on Airey's earlier experience with concrete housing. He had designed and used the Airey Duoslab system in the 1920's. In common with some other concrete house designs of the period, the 1940's Airey house was intended to use the minimum of imported material and to be erected with minimal plant using unskilled labour.

5.2.2 Foundations

Typically, the substructure consists of a concrete strip foundation supporting a 9" brickwork wall. Alternatively, a mass fill concrete foundation may be used.

5.2.3 External Walls

Airey house structures consist of precast concrete storey height columns clad with concrete panels in a ship-lap arrangement. Columns are at 18" centres and panels are 3'0" long and about 11" high. They are attached to the columns by loops of twisted copper wire which pass from hooks on the rear face of the ends of the panels, behind the adjoining columns to similar hooks on the adjoining panels. Columns are exposed in the window openings where they serve as mullions and reveals.

The critical element of the design is the columns. These are exceptionally slender and are reinforced with steel tube, rather than bar reinforcement.

The reinforcement tube extends to the ends of the columns. Jigs with projecting prongs were used to locate columns during construction, and ground and first floor columns were doweled together, as were first floor columns and the roof structure. However, columns with steel tube exposed at the end were stood on a damp proof course to form the ground floor walls.

With no cavity insulation and cladding that was not reliably weather-proof, any water condensing in the cavity, or being driven in from outside, could accumulate around the column feet with inevitable corrosion of the reinforcing tube.

A further factor leading to decay is the small dimension of the column section, approximately 2" by 4". The tube is 1¼" external diameter, so there is little concrete cover protecting the steel and that must be made with small aggregate with an inevitably higher water demand than normal. Consequently, the tube reinforcing an Airey column is liable to rust, both where it is in contact with any water on the dpc and at any point in its height where carbon dioxide has neutralised the alkalis in the thin concrete cover to the steel.

Internally, the columns are usually clad with either fibreboard or plasterboard, secured to a timber fillet cast into the back of the columns. However, Airey properties are occasionally found to have a blockwork lining.



5.2.4 Floors

The ground floor is of solid concrete construction.

First floor joists are sometimes timber, but are more commonly fabricated beams akin to the modern Metsec range. These span from front to rear over a spine wall structure.

5.2.5 Roof

Roofs are traditional pitched timber rafter/purlin construction, with a plain gable. The main roof is clad with either interlocking or plain tiles on felt and battens. Gable apexes are typically clad with plain tiles, although timber or PVCu boarding is occasionally used.

5.2.6 Other

The party wall comprises similar columns to those used for the facade, clad with plain panels. At eaves level, this construction ceases, and the roofspace party wall is formed from either 4½" brickwork or 3" clinker blockwork.

The loadbearing spine wall partition to the ground and first floor consists of similar pre-cast columns to those used for the facade. Non-loadbearing partitions are formed from timber stud framing. Partitions are lined with either plasterboard or fibreboard, as are the ceilings.

The chimneys are of masonry construction.

5.3 Hawksley BL8 Bungalows

5.3.1 Introduction

Hawksley BL8 aluminium bungalows were designed by a body called the Aircraft Industry Research On Housing. Those at Duxford and Sawston were erected in 1951.

5.3.2 Foundations

Typically, the foundations comprise a concrete raft, thickened at the edges. Occasionally though, concrete strip footings supporting a 9" brickwork wall form the substructure.

5.3.3 External Walls

External walls comprise pre-fabricated wall panels, 12'0" long x 8'0" wide, which were brought to site and bolted together.

The panels consist of corrugated aluminium outer sheeting, with building paper on the rear. The sheets are fixed to a timber framing comprising 1¾" x 2¼" timber studs and noggings.

There is approximately 2" thick mineral wool insulation between the studs, and the panels are lined internally with plasterboard.

Around the perimeter of the panels, aluminium channel sections are located. Channels of adjacent wall panels are bolted together by 3 Nr aluminium U-shaped brackets.



5.3.4 Floor

The floor is of solid concrete construction.

5.3.5 Roof

The roof consists of timber trusses, onto which span timber purlins supporting an aluminium profiled roof sheeting. Purlins are connected to the trusses by means of aluminium U-brackets, nailed to the trusses and screwed through the purlins.

A fibreboard lining, approximately $\frac{3}{8}$ " thick, lines the underside of the roof sheeting.

Timber joists span between the trusses, and act as fixing points for the ceiling finish.

5.3.6 Other

The party wall consists of similar wall panels used for the external walls, and is lined with plasterboard.

Typically, partitions are also a panel construction and comprise timber studding with an aluminium channel section around the perimeter. Occasionally, timber stud or paramount board partitions may be used. Both partition walls and ceilings are lined with plasterboard.

The chimney is of masonry construction.

5.4 Industrial Properties

5.4.1 Introduction

The properties at Fulbourn are believed to be Bison large panel system type dwellings.

The Bison system is based upon large storey height precast reinforced concrete panels, with in-situ concrete joints at the junctions of the panels and floor units. The in-situ joints contain steel reinforcement, which tie the panels together and provide continuity to the structure.

The first Bison system dwellings were erected in 1963 and over the years three basic systems evolved, these being the Bison Wall Frame, Bison Crosswall and Bison Preferred Dimension Frame. The properties in question appear to be the Bison Wall Frame type.

5.4.2 Foundations

The foundations consist of a concrete strip footing supporting a concrete ground beam.

5.4.3 External Walls

The Bison Wall Frame system comprises loadbearing storey height precast reinforced concrete (prc) flank-wall and cross-wall panels. The prc floor units of the next storey then bear on the top edge of the panels, with an in-situ concrete joint made at the junction of the panel and floor unit.



Steel dowels, which project from the lower panels, are used to locate and position the panels for the next storey.

Non loadbearing panels, referred to as fascia units, are typically used to clad the front and rear elevations. These are of sandwich construction, comprising two leaves of reinforced concrete separated by a 1" layer of expanded polystyrene. Stainless steel ties were usually used to connect the two leaves together.

The Bison Wall Frame system allows for walls, other than the cross and flank walls, to be finished in a variety of materials other than concrete. Thus, on some variants, timber or PVCu boarding is used to clad part of the dwellings.

The vertical joints of the external wall panels are grooved to locate weatherproofing strips in the outer leaves, whilst the inner leaves are rebated to enable overlapping of reinforcement of adjacent units within the in-situ concrete joint.

Internally, the walls are dry lined with a plasterboard finish.

5.4.4 Floors

The ground floor is of solid concrete construction. The first floor consists of a series of precast units laid alongside each other, which bear upon the gable and party walls.

5.4.5 Roof

A concrete flat roof construction has been utilised, with an asphalt covering, laid to falls.

5.4.6 Other

Partitions consist of timber stud framing lined with plasterboard, whilst ceilings have a hard plastered/artexed finish direct to the underside of the concrete floor.

5.5 Swedish Timber Properties

5.5.1 Introduction

Following a war-time purchasing commission visit to Sweden, Swedish Timber dwellings were imported into the United Kingdom from 1945 onwards. The prefabricated sections were subsequently erected by contractors working for the Ministries of Health & Works and the Scottish Department of Health. It is estimated that approximately 4500 dwellings in total were erected.

5.5.2 Foundations

Typically, the substructure consists of concrete strip foundations supporting a 9" brickwork perimeter wall and 9" and 4½" brickwork honeycomb internal support walls. Air bricks are located within the perimeter walls to provide ventilation beneath the suspended ground floor.



A bituminous felt or asphalt dpc is laid along the perimeter and internal walls. Typically, the oversite cover is concrete.

5.5.3 External Walls

External walls consist of storey height timber frame panels nailed together. The panels comprise 2" x 5" or 2" x 3" timber studs, spaced at centres of up to 4'-9", the 2" dimension being normal to the plane of the wall. The panels contain horizontal timber noggings and, in some instances, timber diagonal braces.

Internally, the panels are clad with 3" x 7/8" tongue and groove vertical boarding, with a building paper backing. The boarding is then faced with 1/8" fibreboard or hardboard.

Externally, the panels are clad with half checked and channelled 3" x 7/8" vertical timber boarding, nailed to the studwork over a bituminous building paper breather membrane.

Fibreboard insulation, 1/2" thick, is provided between the panel frame studs, with the bottom rails of the panels fixed to a separate timber soleplate laid on top of the damp proof course.

5.5.4 Floors

The ground floor is suspended, consisting of 5" x 2" timber joists spaced at 18" centres, finished with 7/8" tongue and groove timber boarding. The joists span between the front and rear walls, with intermediate support provided by brick internal support walls. The joists are notched and bear onto both the timber sole plate and the dpc laid on the substructure brickwork.

The single storey attached outbuilding has solid concrete floor construction.

The first floor comprises 8" x 2" timber joists, spaced at 18" centres, finished with 5 x 7/8" tongue and groove timber boarding. The joists span between the front and rear walls, with intermediate support provided by a ground floor timber stud partition spine wall, over which the joists are notched and nailed. The joists form part of the roof structure in the chalet bungalow variant, which has two dormer windows on the rear elevation.

5.5.5 Roof

The roof comprises 6" x 2" timber rafters spaced at 3'0" centres, with 6" x 2" joists spaced at 18" centres. The joists are notched over a 4" x 2" timber wallplate and are secured to the rafters via timber gusset plates. At approximately the centre of each rafter, a pair of 4" x 7/8" timber collars are located.

The rafters are covered with 7/8" timber tongue and groove sarking boards over which bituminous roofing felt is laid. Timber battens are fixed on top of the felt and the roof is clad with either interlocking or plain tiles.



5.5.6 Other

The party wall consists of 9" solid brickwork, plastered internally. Partitions consist of timber stud framing, clad on both sides with $\frac{7}{8}$ " tongue and groove vertical timber boarding and typically faced with fibreboard or plasterboard. Ceilings are formed with $\frac{1}{2}$ " fibreboard.

The chimneys are of masonry construction.

5.6 Unity Properties

5.6.1 Introduction

The Unity system was devised by architects Kendrick, Findlay and Partners. An early design was used for probably under 100 houses in the 1947-48 period, then a re-design was used to build possibly 3,000 houses between 1948 and 1950. A further re-design in 1950 was used for the next 10 years to build the bulk of the 19,000 Unity dwellings constructed. The properties at Great Shelford are of the latter type and are classified as the 'B' type variant.

5.6.2 Foundations

Foundations consist of a concrete strip footing.

5.6.3 External Walls

The load bearing elements in a Unity house consist of storey height, reinforced concrete columns of $3\frac{1}{2}$ " x 6" cross section, at 3' 0" centres around the house perimeter. The earlier design has columns with an indentation in the sides, giving a dumbbell shaped cross section. However, the later columns, like those at Great Shelford, are of rectangular cross section. Columns are connected by cold-formed steel bracing. Ground floor columns are longer than those at higher levels and have a boot shaped projection at one end. During construction, the boot ends of the ground floor columns were stood on the footing. Typically, the spaces between the columns were infilled with masonry to retain fill below the ground floor structure. On some sites, it has been known to infill the spaces between the columns with mass concrete.

The columns form window reveals and mullions. External walls are clad with stack bonded, unreinforced concrete panels just under 3' 0" long and 11" high, with a clinker blockwork inner leaf. Panels have shaped, interlocking upper and lower edges to reduce rain penetration. Façade panels are tied back to columns by copper straps. These hook onto wires cast into the backs of the panels at one end and are fixed to the side of the columns at the other. Front faces of the columns are treated with bitumen to form a vertical damp proof course between column and cladding.



Generally, the clinker blockwork inner leaf is rarely continuous through the floor void, being supported at each floor level. Tying of the inner leaf to the columns is more primitive than that for the outer leaf. Typically, nails are partially driven into timber plugs cast into the rear face of the columns, hopefully aligned with the bed joints in the blockwork, and built into the wall. Unity houses of the post 1950 type have distinctive square corner panels, which typically are only held in place by steel wire in the bed joints, embedded in generally poor quality concrete infilling in the void behind.

5.6.4 Floors

The ground floor is of solid concrete construction.

The first floor is formed from 4" deep steel joists, spaced at 3' 0" intervals. The floor is finished with tongue and grooved floorboarding, nailed to timber joists that are notched into the webs of the steel joists.

5.6.5 Roofs

The roof is of timber trussed rafter construction, lined with felt and battens and clad with interlocking tiles.

5.6.6 Other

The party wall construction comprises two leaves of 2½" clinker blockwork separated by a 2½" cavity. Loadbearing spine walls are generally of masonry construction, although in some variants there is a loadbearing precast beam spanning the opening between the lounge and dining room.

Internal partitions are typically of clinker blockwork or masonry construction with a hard plastered finish.

Ceilings are formed with plasterboard.

Chimneys are of masonry construction.

5.7 Wimpey Houses

5.7.1 Introduction

"No fines" concrete is a non-proprietary material used widely in England and Scotland for the construction of walls in dwellings. It comprises concrete containing no sand fraction, often using a single size stone (¾" or ½") as the sole aggregate constituent. This creates a honeycomb structure within the concrete. A higher insulation value (lower U-value) is therefore achieved in comparison with dense concrete.

George Wimpey & Co Ltd developed a housing system using no-fines concrete and built upwards of 300,000 low rise dwellings from the 1940's onwards.



5.7.2 Foundations

Typically, foundations comprise a concrete strip footing, with a brickwork substructure built off this to support the external walls above.

5.7.3 External Walls

Generally, the no-fines external walls are approximately 12" thick, with a 1/2" - 3/4" pebbledashed render finish externally and 1/2" - 3/4" hard plastered finish internally.

The external walls incorporate a series of steel reinforcement bars within cast in-situ dense concrete beams at eaves level.

Precast concrete lintels are incorporated into the no-fines walls to provide support above the ground floor openings. Projecting reinforcement from the lintels is lapped to continuous horizontal tie reinforcement within the no-fines walls at first floor level.

5.7.4 Floors

The ground floor is of solid concrete construction.

The first floor construction consists of timber joists with a tongue and grooved floorboard finish.

5.7.5 Roof

Generally, roofs are of traditional pitched timber rafter/purlin construction, clad with interlocking roof tiles on felt and battens.

5.7.6 Other

The party wall construction is formed from no fines concrete, whilst internal partitions are typically of masonry construction. Both have a hard plastered finish.

Ceilings are formed with plasterboard.

The chimneys are of masonry construction.