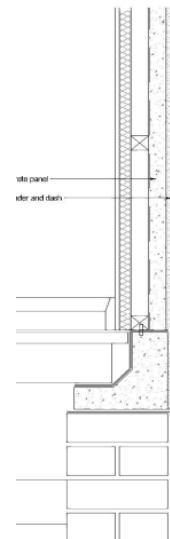
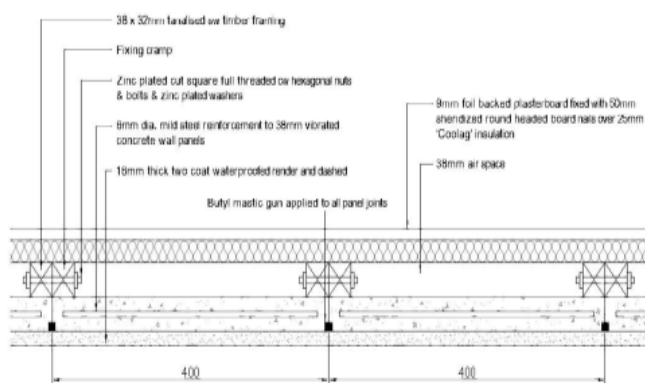


Technical Information Paper

A BRIEF GUIDE TO CONSTRUCTION OF 'CAMBAR' HOUSING IN THE ISLE OF MAN



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With special thanks to Mr Ernie Martin who kindly supplied the photographs taken during construction of camber dwellings in Isle of Man.

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Every effort has been made to ensure the accuracy of information contained within the guide, but authors and Isle of Man Government cannot be held responsible for any inaccuracies that remain.

A BRIEF GUIDE TO CONSTRUCTION OF 'CAMBAR' HOUSING IN THE ISLE OF MAN

December 2014

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TECHNICAL INFORMATION PAPER

A BRIEF GUIDE TO CONSTRUCTION OF 'CAMBAR' HOUSING IN THE ISLE OF MAN

Introduction

The aim of this guide is to provide information and technical details about properties in the Isle of Man constructed by Cambar Ltd, utilising a form of non-traditional Precast Reinforced Concrete Panels, usually single storey and typically built as three bedroom bungalows in early 1980's.

Construction details have been re-drawn from record drawings held by Isle of Man Government Department of Infrastructure.

Synopsis

The 'Cambar' system was based on similar forms of construction used by Dorran in the U.K. and Mantis Ltd on the Isle of Man, but with some significant enhancements to improve robustness and durability within the context of the Island. These include:

- foundation designed to suit the local ground conditions, see typical details Fig 6;
- precast reinforced concrete panels manufactured under controlled factory conditions;
- zinc plated connecting bolts and washers used to link panels together;
- all timber framing and preservative pressure impregnated;
- foil backed plaster board and plaster skim used for internal finishes of all walls and ceilings;
- external elevations have two coats sand and cement render with waterproof additive and spar or pebble dash finish;
- structural joints between precast concrete units sealed using Butyl Sealant;
- prefabricated roof trusses covered with exterior quality plywood sarking prior to fixing slater's felt and battens, providing additional rigidity to the roof and external walls; and
- party walls constructed in 200mm dense concrete brick or blocks and fire stopped to underside of roof covering and over party walls for added protection.

There have been no reported failures or significant problems associated with buildings of this type in either the U.K. or the Isle of Man to date.

Historical Review of Precast Concrete in Housing in UK

The history of precast concrete in U.K. housing dates from the mid-20th century when this and other forms of industrialised (prefabricated) construction were adopted to address the shortage due to the significant loss of housing stock during the Second World War.

More than 250 precast concrete 'systems' have been recorded, but fewer than 100 were deemed to be sufficiently robust or durable to warrant further commercial development.

These included a tranche of 'closed' systems i.e. those constructed from a set of integrated components designed to work together, such as Airey, Boot, Dorran, Myton, Newland, Orlit, Parkinson, Reema, Shindler / Hawkesley, Stent, Tarran, Underdown, Unity, Wates, Whitson-Fairhurst, Winget and Woolaway.

Although by the late 1950's the high demand in the UK for new housing had reached a plateau, in the early 1960's an increase in demand meant that precast concrete systems were again used as an alternative to more labour intensive, conventional construction methods.

By 1960, in the UK over 165,000 precast concrete dwellings had been built, ranging from small single storey bungalows to large high rise (multi-storey) blocks. However, the design and production facilities used in previous decades had all but disappeared.

In the U.K. in 1981, after over forty years in service, structural cracks were discovered during renovation works to some Airey type houses (Martin, 1999a; Martin, 1999c). This led to further investigations by the Building Research Establishment (BRE)* on 17 common precast concrete house types which revealed serviceability problems. In total, about 3,000 houses were inspected visually and 450 houses were investigated in detail; of this number, none were found to be structurally unsafe. The problems discovered during the BRE investigations, were mainly extensive cracking and spalling of the concrete arising from corrosion of the steel reinforcement within the concrete panels.

The reports concluded that the corrosion of the reinforcement was due mainly to:

- carbonation of concrete;
- high levels of Chloride present in the concrete;
- low cover to the reinforcement;
- poor quality of the concrete;

These problems were attributed to poor quality manufacture, poor quality of construction, and lack of concrete materials knowledge. The solutions to the problems ranged from overcladding the existing houses with masonry, to replacing the defective elements with traditional build forms. To ensure good quality repair and rehabilitation, the National House Building Council (NHBC) was also asked by the U.K. Government to set up a company to licence appropriate repair systems for these applications.

*BRE – The structural condition of Dorran, Myton, Newland and Tarran houses

Cambar Limited Construction Specifications in the Isle of Man

General

Precast reinforced concrete panel houses constructed in the Isle of Man developed from Dorrán/Mantis systems for the main load bearing walls. Floor and roof are of traditional timber construction. The vast majority of these were built in accordance with 1976 Building Byelaws applicable in the Isle of Man at the time of construction. The Isle of Man adopted England & Wales Building Regulations in May 1993. The concrete panels were cast in factory conditions and in various lengths and taken to site once cured and ready for assembly on site. There have been no reported failures or significant problems associated with 'Cambar' buildings in U.K. or the Isle of Man to date. In fact recent works to extend some properties have revealed the robustness of the original construction (see pictures page 18).

Summary of technical specifications

As noted previously Cambar Houses were constructed in the Isle of Man with a number of significant enhancements figures 1 and 2 show a typical Cambar House.

Foundations

Foundations are generally 500mm wide x 225mm deep cast in-situ concrete strip footing with a minimum of 230mm brick work supporting the main loadbearing components.

Ground Floor

19mm flooring grade T&G chipboard on 100mm x 50mm joists at 400 centres on 75mm x 50mm tanalised, (preservative pressure impregnated) wall plate on DPC over 102mm honeycomb brick sleeper walls. See figs 7 and 8.

First Floor

Except for a few commercial buildings, all properties constructed are bungalows.

Roof

Concrete interlocking tiles on battens on bituminised sarking felt on 9mm exterior quality plywood on prefabricated trussed rafters at 600mm centres with 12.5mm plasterboard with 100mm glass fibre insulation material laid over ceiling joists. See figs 3 and 4.

Framing

The external walls are made up from reinforced concrete panels of differing heights approx. 400mm wide and 38mm thick fixed onto 38mm x 32mm tanalised soft wood timber framing. See Figs 5 and 6.

Construction of External Wall Panels

6mm diameter mild steel reinforcement in 38mm thick vibrated concrete panels fixed with zinc plated cut square full threaded CW hexagonal nuts, bolts and zinc plated washers with fixing clamps to timber framing. Butyl Sealant mastic applied to all panel joints. See Wall Unit Detail Figs 9, 10 and 11.

Party walls

Party walls are made of 200mm brick or blocks to underside of roof covering and fire stopped to underside of sarking.

Internal Partitions

Internal partitions constructed from 75mm x 50mm timber stud partitions at 400mm centres with 9mm foil backed plaster board to both sides.

Internal Finish

9mm foil backed plasterboard fixed with 50mm sheradised round headed board nails over 25mm 'Coolag' insulation pinned to the framing of external walls.

External Finish

All external walls provided with two coats of waterproofed sand/cement render having spar or pebble dashed finish.

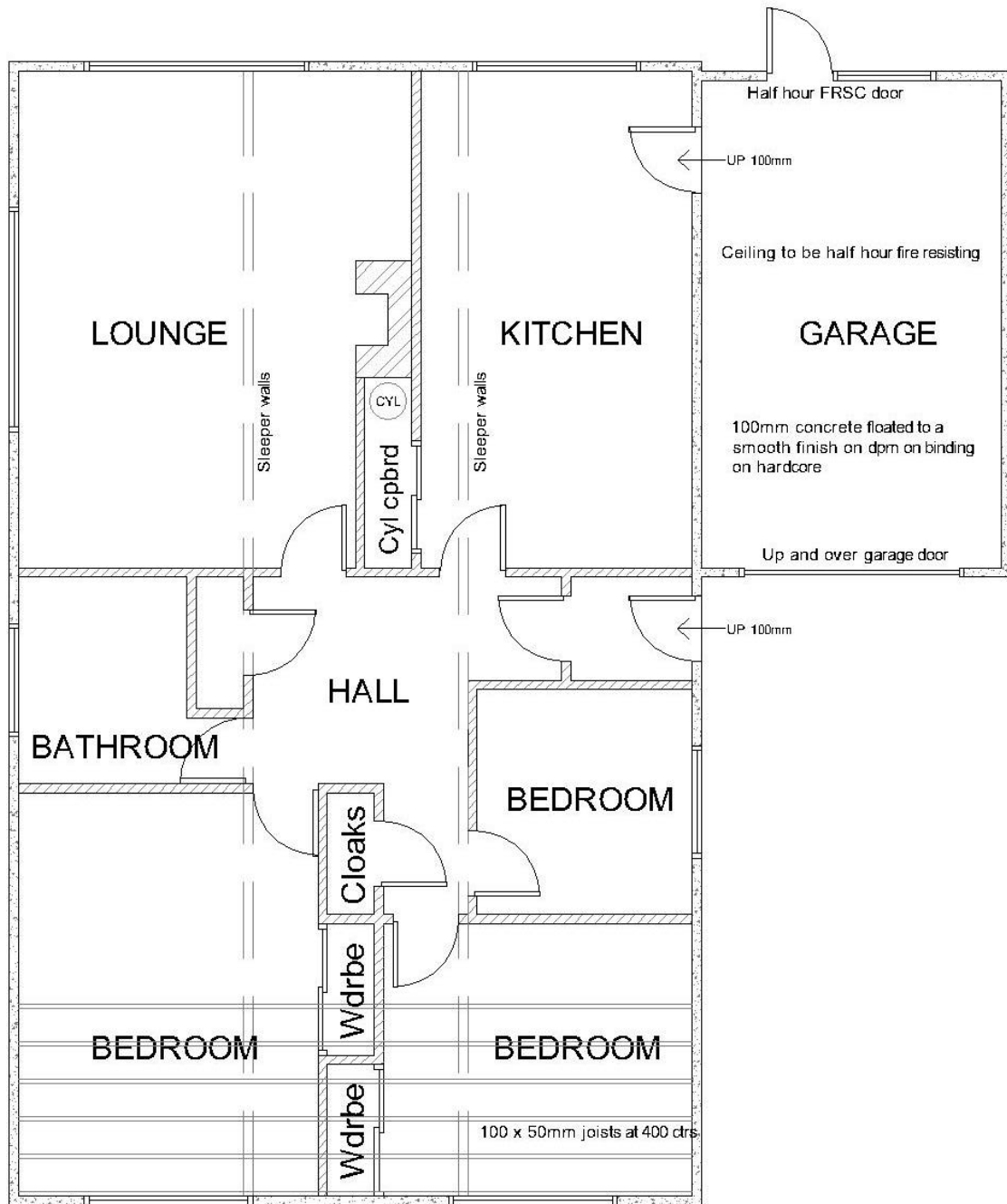


Fig.1.
Typical Floor Plan

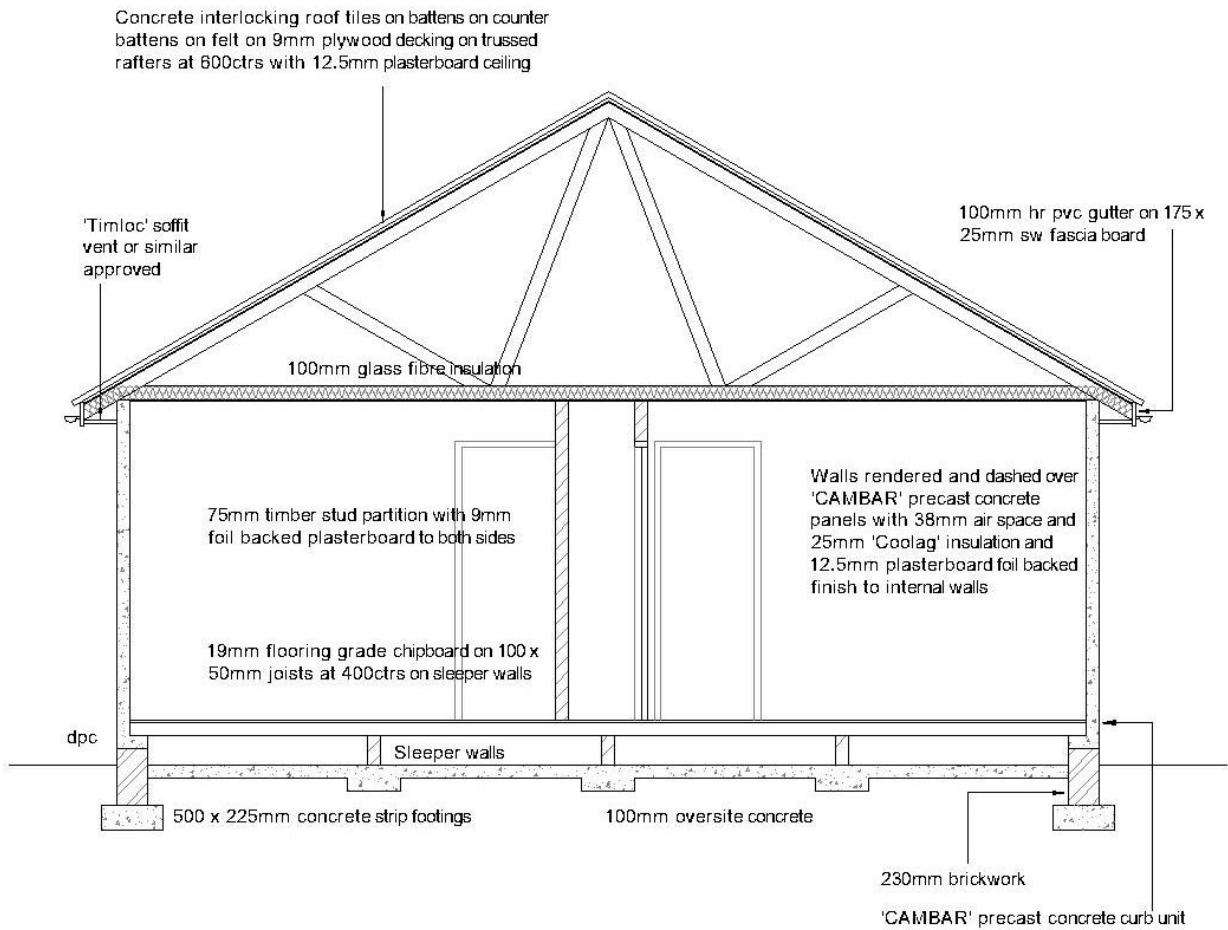


Fig.2.
Typical Section



Property under construction

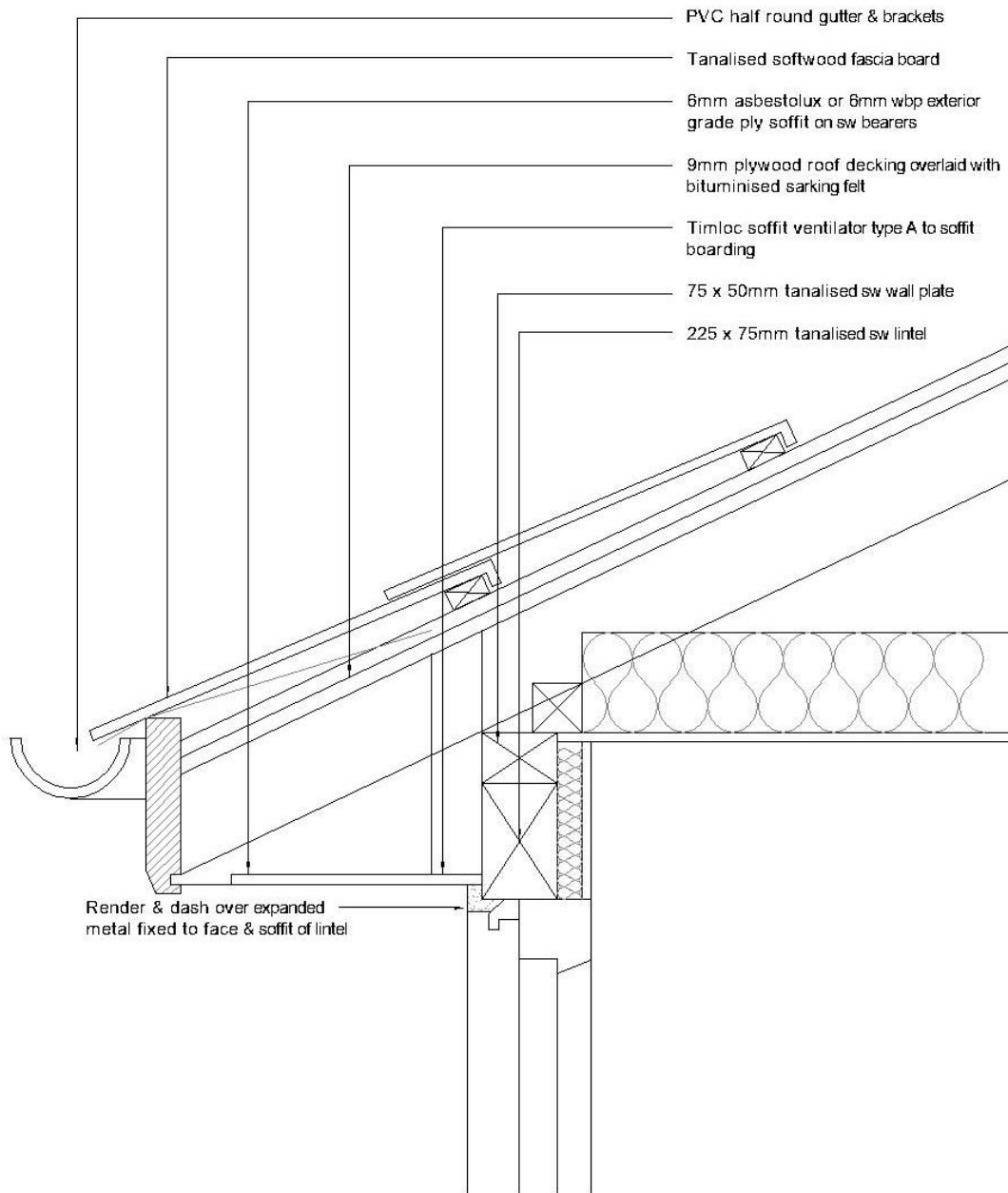


Fig.3.
Roof Eaves Details



Property under construction

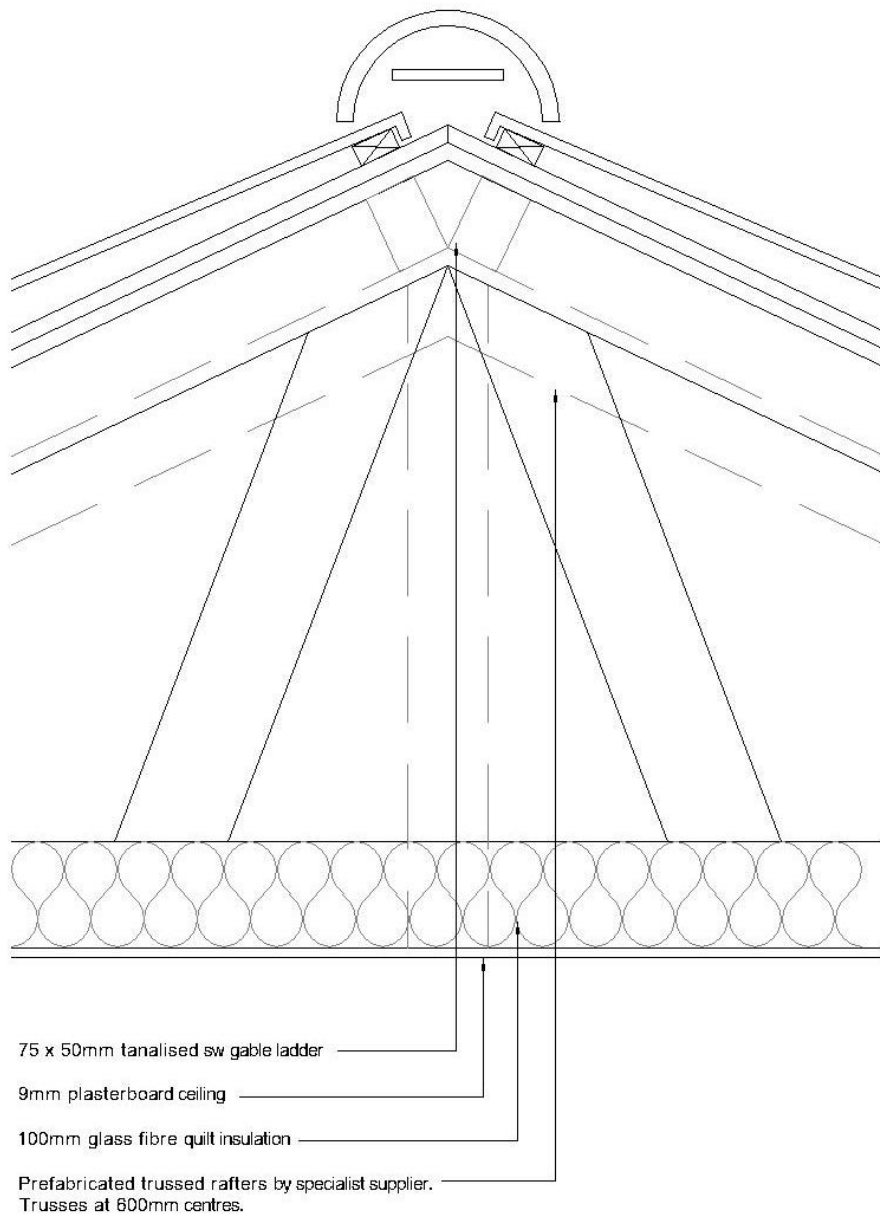


Fig.4.
Roof & Ceiling Details



Property under construction

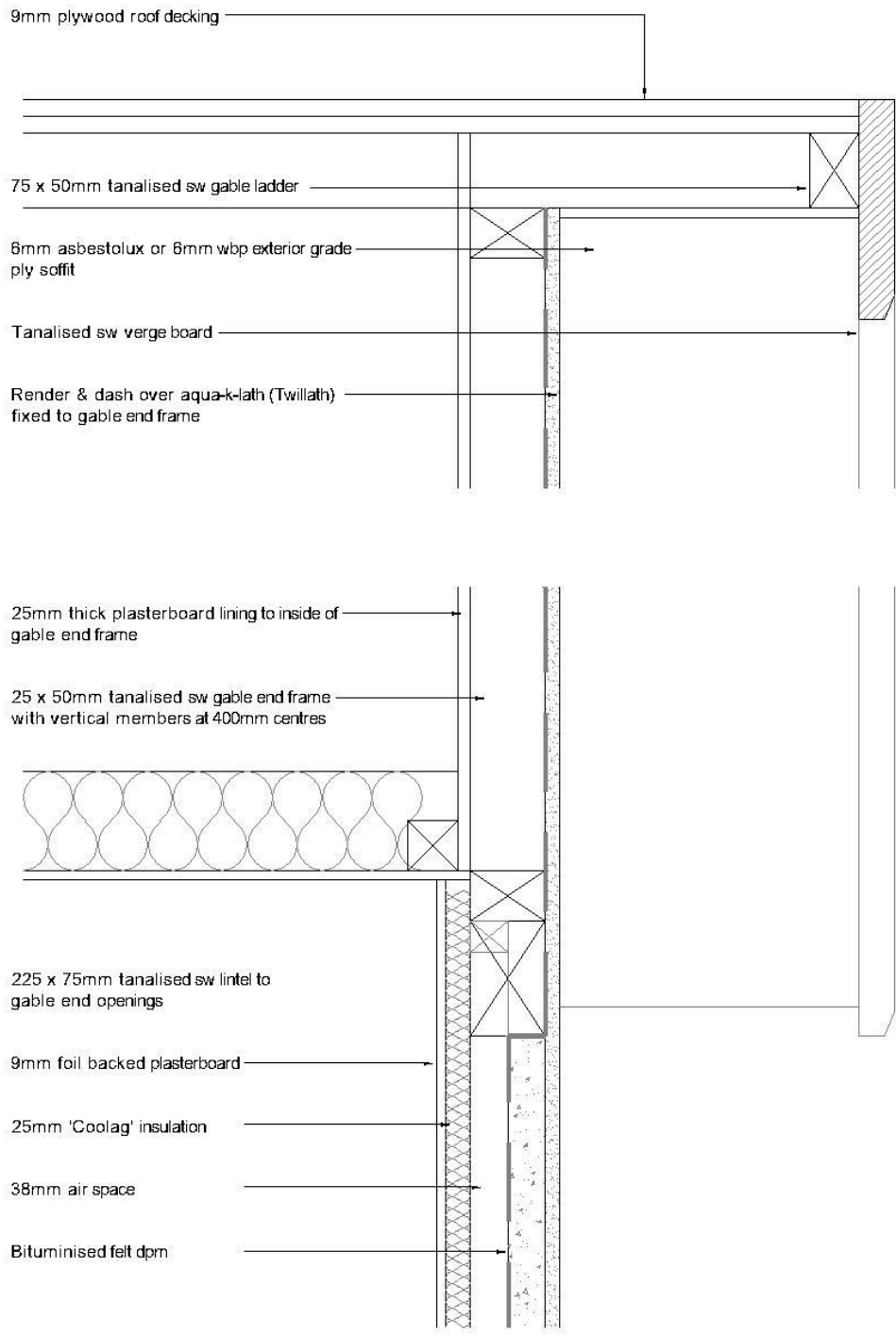


Fig.5.
Roof Verge / Gable Detail

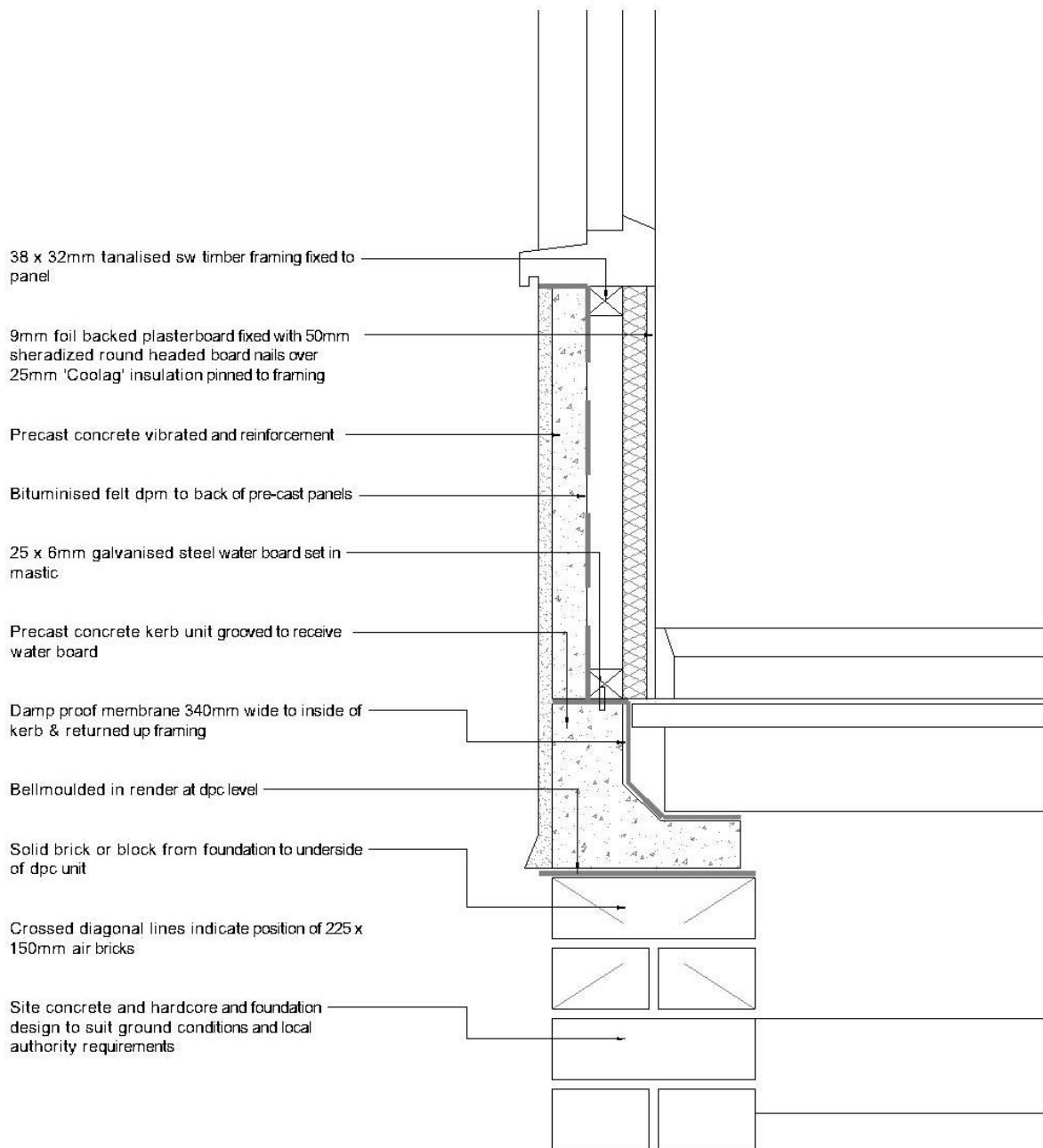


Fig.6.
External Wall & Foundation Detail

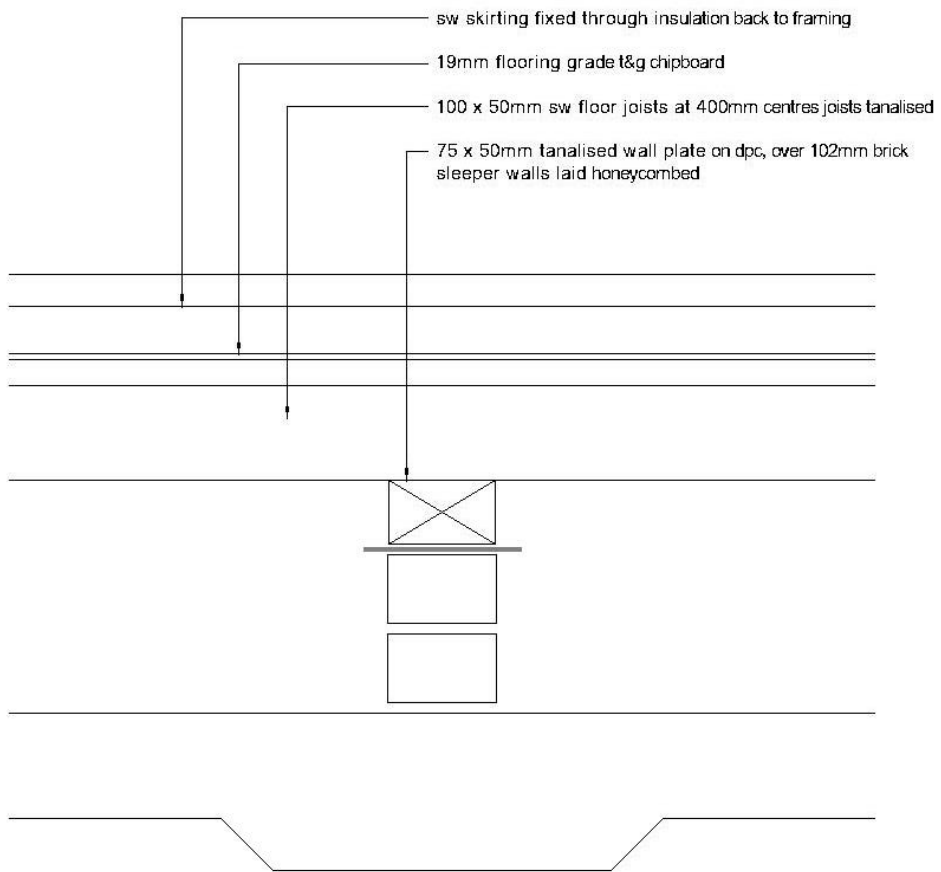


Fig.7.
Floor & Sleeper Wall Detail

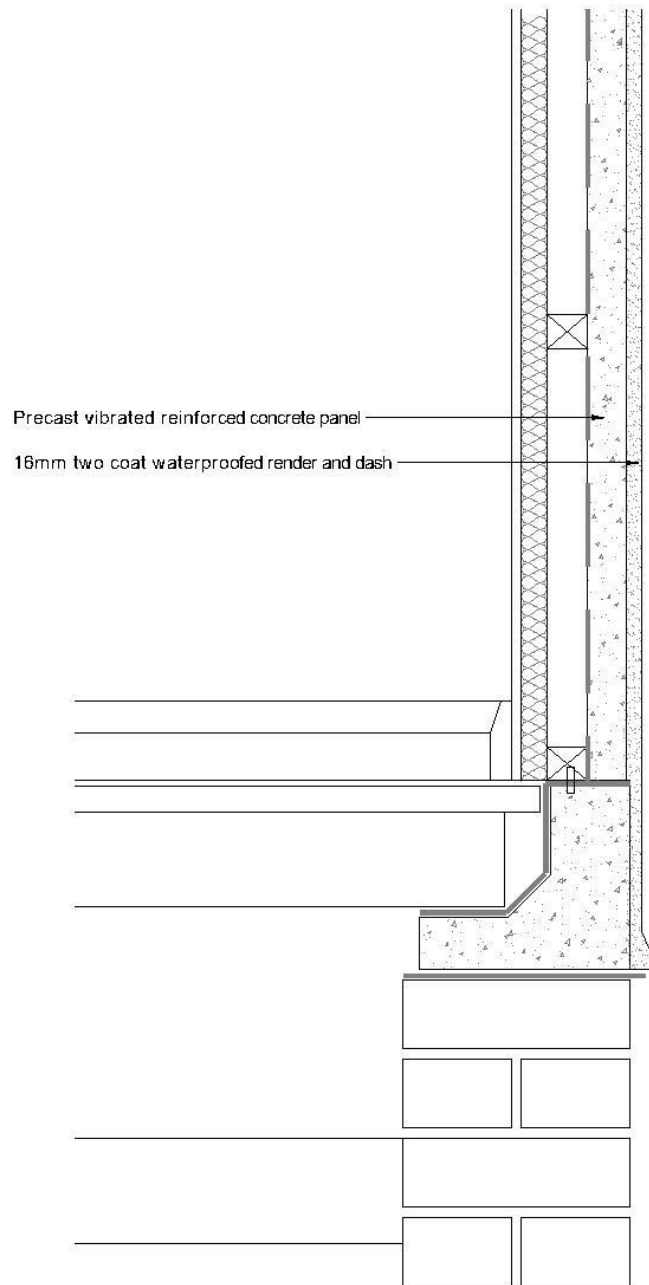


Fig.8.
External Wall Detail

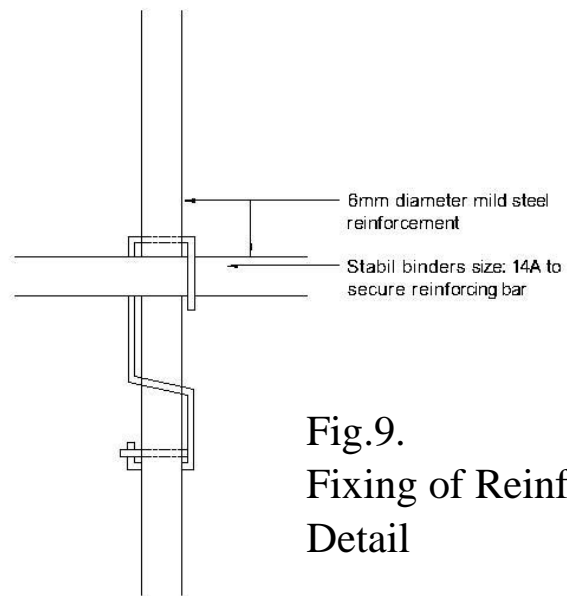


Fig.9.
Fixing of Reinforcement
Detail

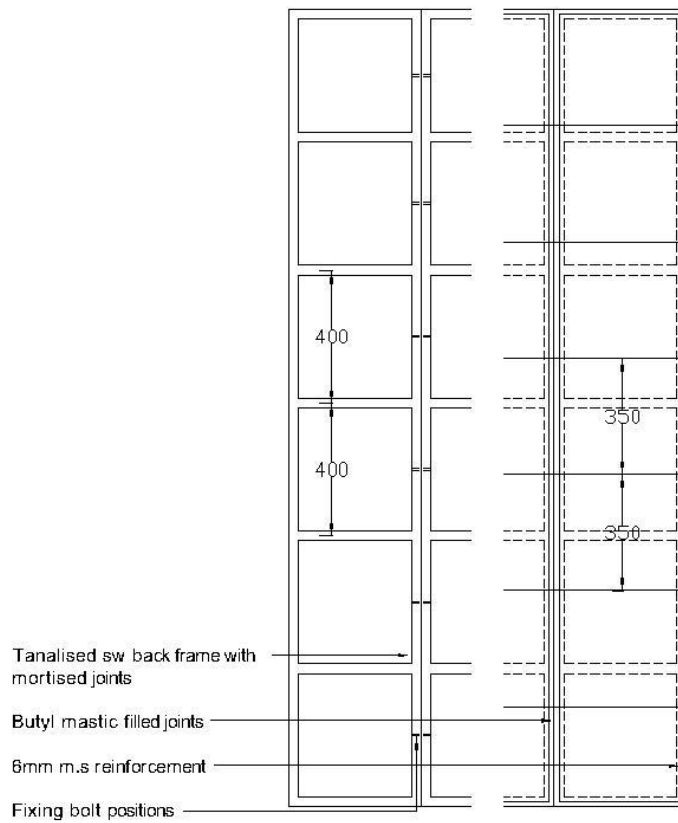


Fig.10.
Rear of Panel

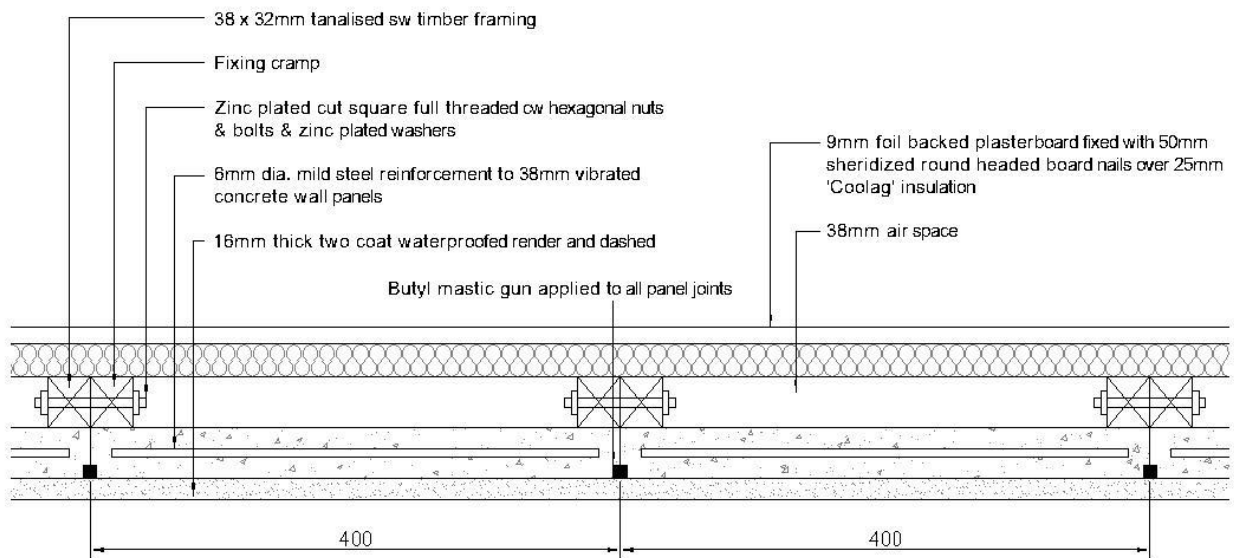


Fig.11.
Wall Unit Detail in Plan



Garage external wall panels exposed during alterations in 2014



Garage external wall panels exposed during alterations in 2014



Construction of property



Construction of property



Construction of property



Construction of property



Construction of property



Construction of property



Completed property



Completed property



Completed property



Completed property