



University of Wales
Trinity Saint David

REPORT

FUNDAMENTALS OF CONSTRUCTION TECHNOLOGY ACBA4022

Course: HNC Quantity Surveying

Student: Alejandra Montecinos Cardenas 2516542

Lecture: Rhodri Tomas

Table of Contents

Case Study: Rhyd-y-car Terrace, St Fagans National Museum of History	3
Objectives.....	3
Introduction.....	3
Part 1: EVOLUTION OF CONSTRUCTION AND BUILDING ELEMENTS	4
Windows and Doors.....	4
Windows	4
Doors.....	4
Wall Coverings	5
Roof Coverings	6
Eaves details and Rainwater goods.....	7
Floor Coverings.....	7
Internal Joinery	8
Conclusion	8
Part 2: CONSTRUCTION METHODS (OVERVIEW FOR SKETCHES).....	9
Appendices.....	10
Appendix A- Windows and Doors by year.....	11
Appendix B- Photographic evidence of Floor coverings by year.....	12
Appendix C- Photographic evidence of Internal Joinery by year (Museum Wales, no date).....	13
Appendix D- Labelled sketches showing the typical construction methods for houses built:	14

Case Study: Rhyd-y-car Terrace, St Fagans National Museum of History

Cardiff, Wales

Objectives

1. To analyse the evolution of construction methods, materials and architectural elements of the Rhyd-y-car Terrace dwellings across different historical periods, identifying the technical, social and functional reasons that led to these changes.
2. To evaluate how modifications to windows, wall construction, roof coverings, floor construction and internal finishes contributed to improved building performance in terms of durability, occupant comfort, moisture control and energy efficiency, when compared with the original construction solutions.

Introduction

Rhyd-y-car Terrace is a row of six modest workers' dwellings originally constructed around 1795 by ironmaster Richard Crawshay to house employees working at his ironworks and associated iron-ore mines in Merthyr Tydfil, which was the largest town in Wales, with a population of 7,000. Each dwelling contains a living room with bedroom above, accessed by a steep circular staircase next to the fireplace. A second bedroom and small pantry are located at the back beneath a 'cat-slide' roof. (Museum Wales, n.d.a) The terrace represents a significant example of late eighteenth-century industrial housing in South Wales and reflects the social, economic and technological conditions of the period. It is important to note that iron ore miners were part of the upper working class and could afford luxury items.

In 1982-1983 the terrace was reconstructed at St Fagans National Museum of History, where each dwelling has been restored to represent a different stage in its historical development: 1805, 1855, 1895, 1925, 1955 and 1985. (Museum Wales, n.d.b) ('Rhyd_y_car.en.pdf', no date)



Figure 1. Rhyd-y-car Terrace

As part of *Fundamentals of Construction* module, in this case study will describe the differences in these different houses and will explain why these changes were made. Also, it will examine the physical and material changes that occurred across these six periods, focusing on how building elements evolved in response to defects in earlier construction, improvements in materials and technology, changing social expectations, and emerging building standards. The study concentrates on windows and doors, wall coverings, roof coverings, eaves and rainwater goods, floor construction, and internal joinery. Understanding these changes is essential for appreciating the performance of historic buildings and for informing conservation and adaptation strategies in modern practice (Cadw, 2019)

Part 1: EVOLUTION OF CONSTRUCTION AND BUILDING ELEMENTS

Windows and Doors

Windows

In 1805 and 1855, windows in this cottage were typically small timber-framed casements with single glazing and did not open. As glass was expensive and limited in size, window openings were restricted, resulting in relatively poor natural lighting and ventilation. (Curl and Wilson, 2015). From a performance perspective, small windows reduced heat loss, but they also contributed to dark, poorly ventilated interiors.

By 1895 dwelling had sash windows, which allowed fresh air into the cottage. Industrialization had reduced the cost of glass production, enabling larger window openings and improved daylighting. Timber sash windows became more refined, featuring better joinery and improved weather detailing. These changes reflected rising living standards and an increased awareness of health, light, and ventilation (Museum Wales, n.d.b), ('Rhyd_y_car.en.pdf', no date)

In houses built in the 1925 and 1955 periods, window sizes increased further, and frames were manufactured with greater consistency, sometimes incorporating metal elements.

By 1985, PVC double-glazed windows had been introduced, significantly improving thermal and acoustic performance while reducing condensation in line with growing expectations for energy efficiency. (Chudley, Greeno and Kovac, 2020)

Doors

In 1805 external doors were made of solid timber planks, often braced and ledged, which provided basic security but little resistance to air infiltration. (Chudley, Greeno and Kovac, 2020)

By 1855, 1895 and 1925 Paneled timber doors became more common, improving both appearance and durability.

By 1955 and 1985 doors were a traditional timber frame and ledged external door incorporating a single glazed panel.

Photographic evidence of windows and doors can be found in Appendix A.

Wall Coverings

Around 1805 wall finishes consisted primarily of lime plaster applied directly to solid stone masonry. Lime plaster was well suited to traditional construction, as it allowed moisture to evaporate through the wall, reducing the risk of damp. However, finishes were often uneven and prone to cracking.

By 1855 decorative wall covering had begun to evolve influenced by industrialisation and changing socials. Although lime plaster remained the dominant base material, the growing availability of machine-produced wallpaper made decorative finishes more accessible to a wider range of households.

During the nineteenth century, decorative finishes such as wallpaper became increasingly common, particularly by 1895. This change was driven by social aspiration and improved manufacturing techniques. (Museum Wales, n.d.b)

By 1925 and especially 1955, gypsum plaster was widely adopted due to its faster setting time and lower labour costs. Gypsum set more quickly than lime and required less skilled labour, making it an attractive option for builders during a period of rapid housing expansion.

While gypsum plaster produced smoother finishes, it was less breathable than lime, which in some cases contributed to moisture-related defects in solid-walled buildings. (Cadw, 2019)



Figure 2. Changes in Wall Coverings across the years.

By 1985, wall finishes typically included emulsion paints and, in some cases, internal insulation systems. These changes reflected a greater emphasis on comfort, appearance and energy efficiency, although they also required careful detailing to avoid trapping moisture within traditional wall constructions. However, the introduction of impermeable finishes and insulation layers in traditional buildings demanded careful detailing to avoid trapping moisture within the wall fabric, an issue highlighted in conservation guidance such as English Heritage (2012).

Year	Wall covering methods and its characteristics
1805	Lime plaster applied directly to solid masonry. Highly breathable finish allowing moisture to evaporate through the wall. Surfaces often uneven and prone to cracking. Limited use of hand-printed wallpaper, mainly in affluent households.
1855	Growth of machine-produced wallpaper due to industrialisation. Increased affordability and wider decorative choice. - Lime plaster still common, often combined with decorative mouldings and friezes. Victorian interiors favouring rich colours and ornate patterns.

1895	Wallpaper becomes widespread across British homes. Designs soften towards the end of the Victorian period; lighter colours more common. Influence of Arts & Crafts movement with natural, handcrafted motifs. Smoother plaster surfaces and reduced excessive ornamentation.
1925	Quickly adoption of gypsum plaster for its quick setting time and lower labour cost. Smoother, more uniform surfaces suitable for simple wallpapers or painted finishes. Reduced breathability of gypsum contributing to moisture issues in solid-walled buildings.
1955	Gypsum plaster becomes the standard finish in new housing. Popularity of modern wallpapers and improved paint formulations. Functional, easy-to-maintain interiors reflecting post-war reconstruction needs. Emphasis on efficiency and affordability.
1985	Widespread use of emulsion paints, vinyl wallpapers and washable finishes. Introduction of internal insulation systems in some properties. Decorative trends range from minimalist to bold textured wallpapers (e.g., anaglypta, woodchip). Need for careful detailing to avoid moisture being trapped in traditional wall constructions.

Figure 2.1. *Comparative evolution of wall coverings in UK dwellings*

Roof Coverings

Throughout the terrace's history, locally sourced slate remained the dominant roof covering. In the earliest houses, slates were fixed directly to timber battens without underlay, leaving the roof vulnerable to wind-driven rain and draughts.

By the late nineteenth and early twentieth centuries, improvements in fixing methods and workmanship increased roof durability. The introduction of bituminous felt underlay by the mid-twentieth century significantly improved weather resistance and reduced water penetration. Ridge tiles also became mechanically fixed, enhancing resistance to wind uplift. (Historic England, 2012)

Although the material remained largely unchanged, these incremental improvements greatly enhanced the roof's performance and longevity while retaining its traditional appearance. (Chudley, Greeno and Kovac, 2020)



Figure 3. *View of Roof Coverings*

Eaves details and Rainwater goods

In eighteenth century, eaves details were simple, often with minimal overhang. Rainwater was managed using timber gutters or stone channels, which were susceptible to leakage, decay and blockages. As a result, walls were frequently exposed to excessive moisture, leading to damp-related problems. (Historic England, 2012)

By the late nineteenth century, cast iron gutters and downpipes became common, offering greater durability and improved water management. These systems significantly reduced the risk of penetrating damp at wall heads and junctions (Cadw, 2019). In the mid-twentieth century (1955), lighter metal or early plastic rainwater goods were introduced, reducing maintenance requirements.

By 1985, modern plastic rainwater systems with improved jointing and fixing methods were standard. These developments reflected an increased awareness of moisture control, maintenance efficiency and long-term building performance. (Chudley, Greeno and Kovac, 2020)

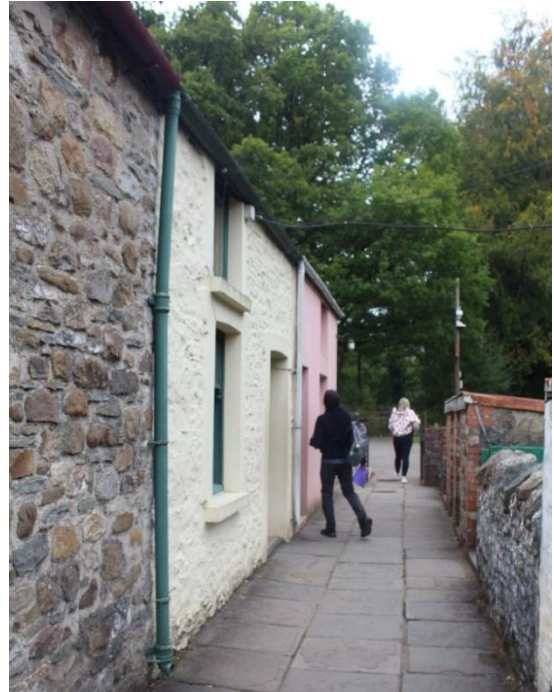


Figure 4. View of rainwater system

Floor Coverings

The ground floors of the earliest houses were typically made of stone flags laid directly onto compacted earth. While these floors were these durable, they were cold and uncomfortable, and highly susceptible to rising damp. Upper floors were made of timber boards supported by joists. (Historic England, 2012)

By the late nineteenth and early twentieth centuries, suspended timber ground floors has become more common, improving ventilation beneath the floor and reducing moisture-related issues. However, draughts and heat loss remained significant issues.

In the mid-twentieth century (1955), concrete ground floors became increasingly popular. While these floors were more durable and easier to maintain they initially lacked insulation. By 1985, concrete floors typically incorporated damp-proof membranes and insulation, greatly enhancing thermal comfort and reducing energy consumption. (Chudley, Greeno and Kovac, 2020). Vinyl floorings and Carpets were also introduced on this date to cover the floors in certain areas of the home.

Photographic evidence of Floor Coverings can be found in Appendix B.

Internal Joinery

The Internal joinery of early houses was functional and minimal. The rustic oak furniture reflects the economic constraints of workers' housing. Doors were plain, staircases were steep and exposed, and decorative features such as skirting boards and architraves were scarce. (Curl and Wilson, 2015)

From around 1850 onwards, living conditions began to improve as coal overtaken iron as the dominant industry. Throughout the late nineteenth and early twentieth centuries, standards of domestic comfort continued to rise, with features such as panelled doors, moulded skirtings and enclosed staircases becoming increasingly common. These features enhanced both the appearance and functionality of homes. However, it is important to note that, between 1800 and 1860, most dwellings still lacked basic amenities such as piped water and indoor toilets.

By 1925 running water had reached the houses for the first time.

By the mid-to-late twentieth century, factory-produced joinery enabled greater consistency and reduced costs. Design decisions were increasingly influenced by fire safety, durability and ease of maintenance, particularly in houses built in 1955 and 1985. (Museum Wales, n.d.a)

Photographic evidence of Internal Joinery can be found in Appendix C.

Conclusion

The Rhyd-y-car Terrace houses provide a clear and interesting illustration of the evolution of domestic construction over nearly two centuries. The growing demand for housing in the United Kingdom was mainly driven by the Industrial Revolution and the expansion of the iron industry. Early constructions prioritised the availability of materials and providing basic shelter, often at the expense of comfort and performance. Over time, technological advances, improved materials, and changing social expectations have addresses defects such as dampness, poor thermal performance and poor lighting. The later houses demonstrate a growing focus on energy efficiency, durability and occupant comfort.

This case study highlights the importance of understanding historic construction techniques when conserving or adapting traditional buildings and explains why these changes were made. The main reasons for these changes were to improve living conditions, comfort, wellbeing and health of the occupants. While modern interventions can significantly improve performance, they must be carefully designed to remain compatible with the original construction. Rhyd-y-car Terrace therefore offers valuable lessons for contemporary construction, conservation, and building performance assessment. It is also a great place for aspiring engineering professionals to learn.

Part 2: CONSTRUCTION METHODS (OVERVIEW FOR SKETCHES)

The construction methods illustrated in the accompanying sketches reflect broader changes in building technology and regulation. Pre-1900 construction relied on shallow foundations, solid masonry walls, lime mortar and minimal moisture or thermal control. (Historic England, 2012). By the 1950s, deeper foundations, damp-proof courses, concrete floors and improved roof detailing had become standard. Post-2000 construction demonstrates a holistic approach to performance, incorporating insulated cavity walls, damp-proof membranes, double glazing and high levels of thermal insulation throughout the building envelope. ('LCON-Housewarming_H2_Insulation_Digital_29Jun23.pdf', no date)

To view the sketches illustrating these construction methods, please refer to Appendix D.

References

Cadw (2019) *Understanding Traditional (pre-1919) and Historic Buildings for Construction and Built Environment Courses* | Cadw. Available at: https://cadw.gov.wales/learn/education/teaching-resources/understanding-traditional-pre-1919-and-historic-buildings?utm_ (Accessed: 4 January 2026).

Chudley, R., Greeno, R. and Kovac, K. (2020) *Chudley and Greeno's Building Construction Handbook*. 12th edn. London: Routledge. Available at: <https://doi.org/10.1201/9780429027130>.

Curl, J.S. and Wilson, S. (2015) *The Oxford Dictionary of Architecture*. Oxford University Press.

Historic England (2012) *Practical Building Conservation Series* | *Historic England*. Available at: <https://historicengland.org.uk/advice/technical-advice/buildings/practical-building-conservation/> (Accessed: 4 January 2026).

'LCON-Housewarming_H2_Insulation_Digital_29Jun23.pdf' (no date). Available at: https://lcon.org.uk/wp-content/uploads/2023/07/LCON-Housewarming_H2_Insulation_Digital_29Jun23.pdf (Accessed: 8 January 2026).

Museum Wales (n.d.a) *Historic Buildings, Museum Wales*. Available at: <https://museum.wales/stfagans/historic-buildings/> (Accessed: 4 January 2026).

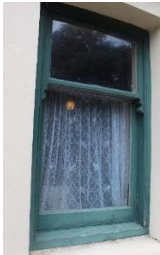
Museum Wales (n.d.b) *Rhyd-y-Car cottages - Collections Online, Museum Wales*. Available at: <https://museum.wales/collections/historic-buildings/29/Rhyd-y-car-Terrace/> (Accessed: 5 January 2026).

Museum Wales (no date) *Virtual Tour of Rhyd-y-car: Homes through Time, Museum Wales*. Available at: <https://museum.wales/learning/activity/401/Virtual-Tour-of-Rhyd-y-car-Homes-through-Time-/> (Accessed: 5 January 2026).

'Rhyd_y_car.en.pdf' (no date). Available at: https://museum.wales/media/9677/Rhyd_y_car.en.pdf (Accessed: 5 January 2026).

Appendices

Appendix A- Windows and Doors by year

Year	Window	Door
1805		
1855		
1895		
1925		
1955		
1985		

Appendix B- Photographic evidence of Floor coverings by year

Year	Photograph	Brief Description
1805		Flagstone floor laid directly over compacted earth.
1855		Flagstone floor laid directly over compacted earth.
1895		Flagstone floor laid directly over compacted earth.
1925		Flagstone floor laid directly over compacted earth. Concrete floor and earlier carpets.
1955		Vinyl Flooring and ceramic tiles.
1985		Vinyl flooring and carpet.

Appendix C- Photographic evidence of Internal Joinery by year (Museum Wales, no date)

Year	Photograph	Brief Description
1805		Rustic oak furniture
1855		Rustic oak furniture
1895		It features finely crafted timber furniture and decorative joinery.
1925		Enclosed timber staircases, moulded skirtings, and framed wall panelling typical of late Victorian joinery.
1955		Traditional timber furnishings highlight the structural and aesthetic role of joinery in rural interiors. By this year there was electricity.
1985		Painted timber cabinets, fireplace surrounds, and skirtings reflect mid-20th century domestic joinery with modest decorative features.

Appendix D- Labelled sketches showing the typical construction methods for houses built:

- Pre 1900
- 1950's
- Post 2000

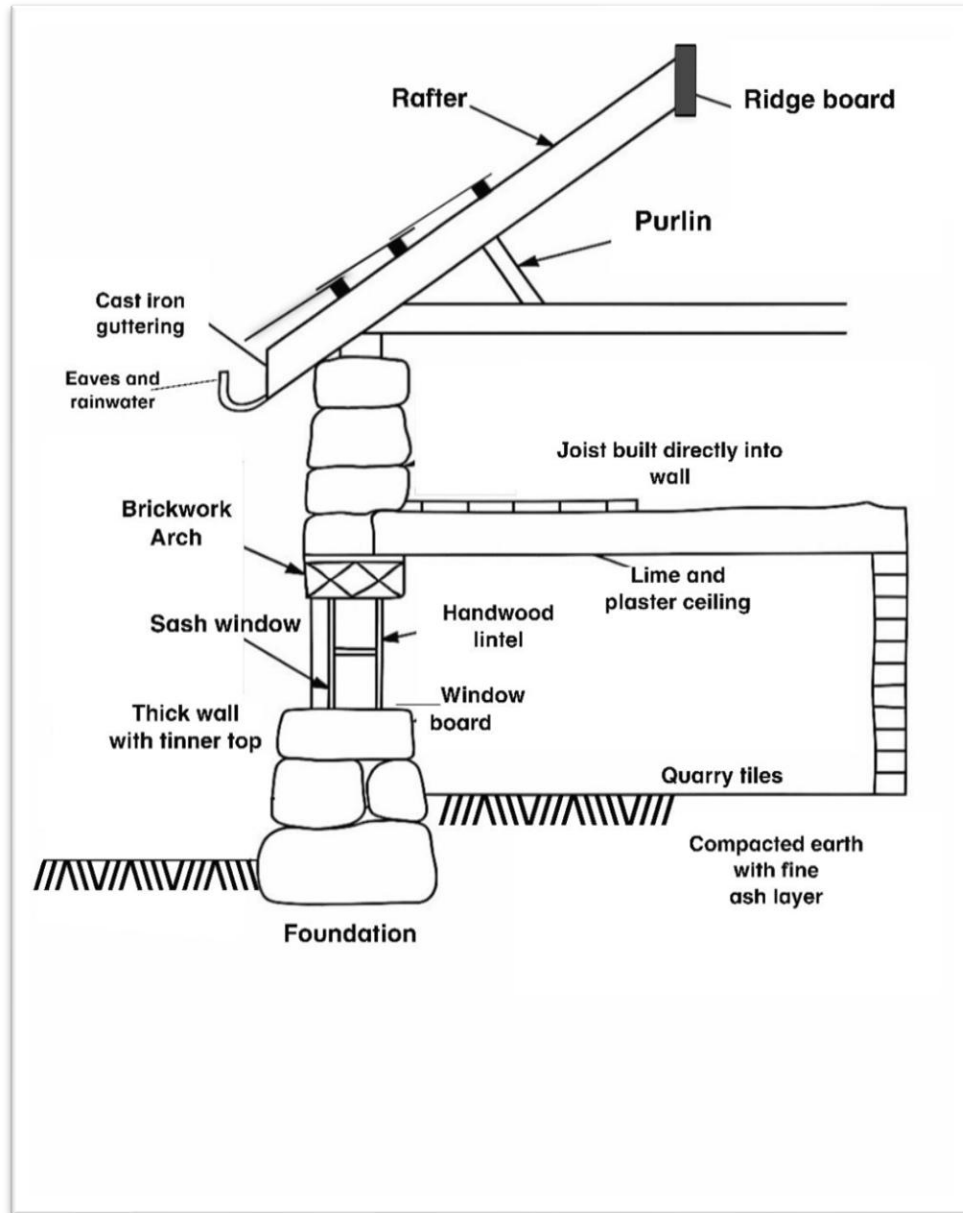


Figure 5 Labelled Sketch Pre 1900

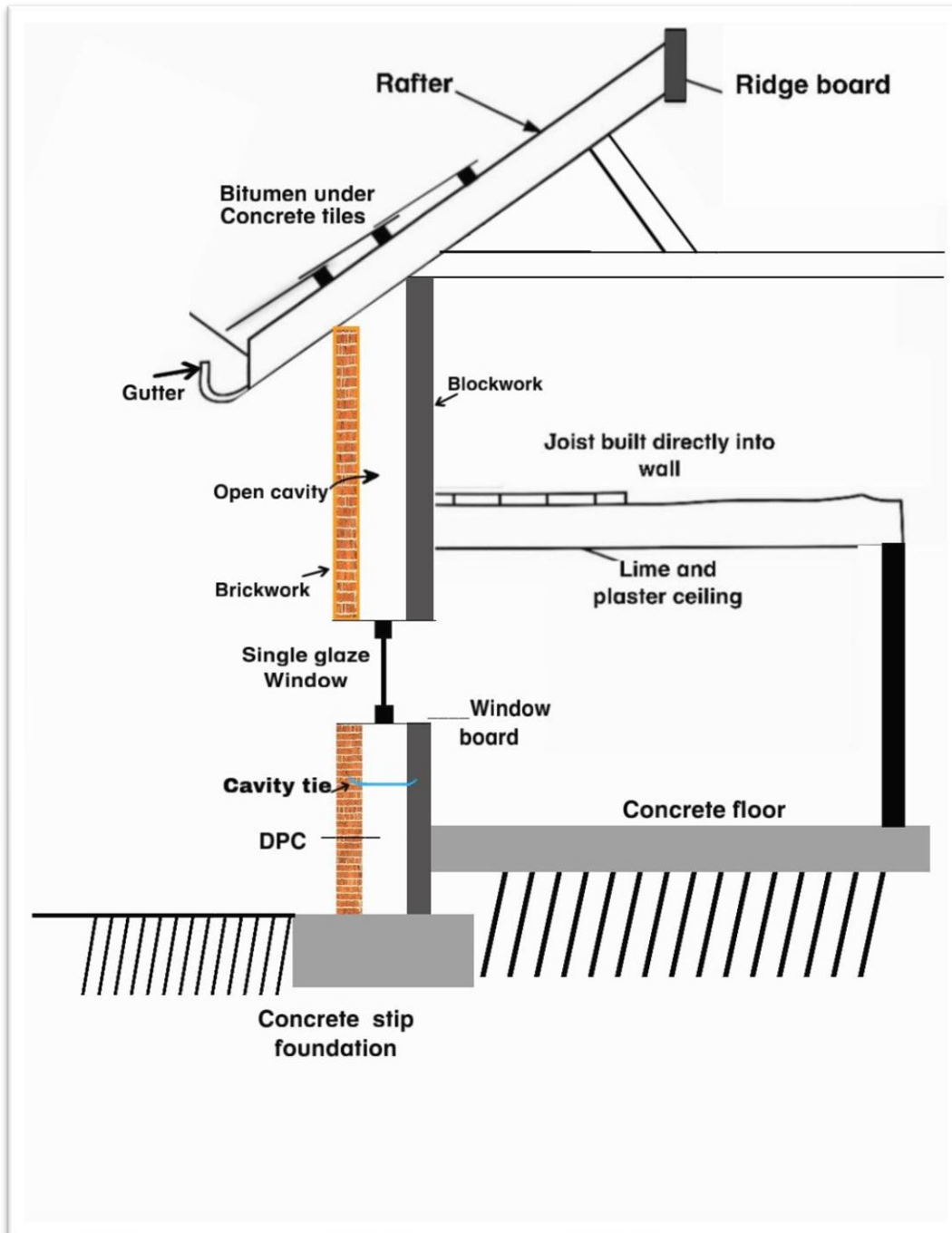


Figure 6. Labelled Sketch 1950

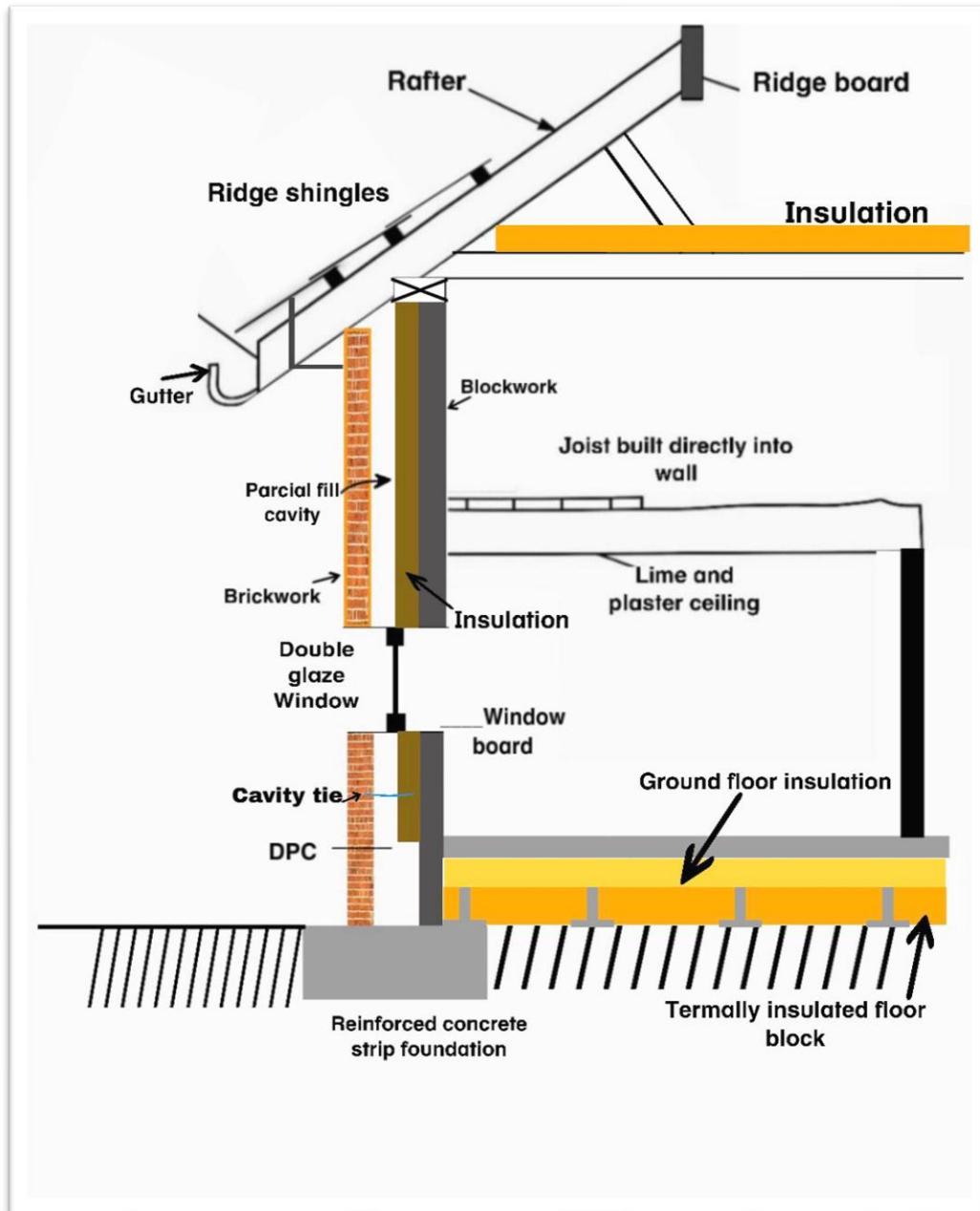


Figure 7. Labelled Sketch Post 2000