

# **Designing with the vernacular in relation to planning & Passivhaus - An Irish perspective**

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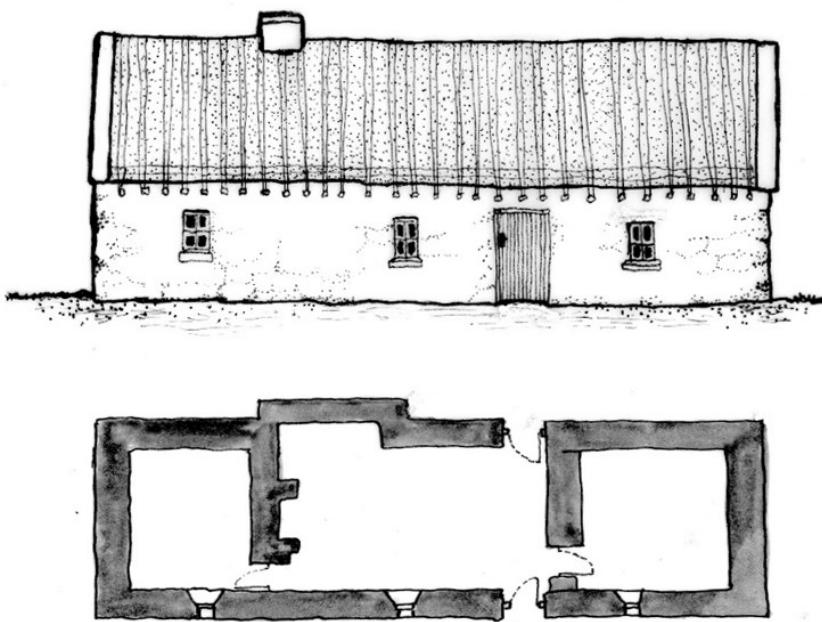
## **Vernacular Design and Passivhaus – an Irish perspective**

### **Introduction**

The purpose of this paper is to give an understanding of the Irish vernacular, residential design and to demonstrate in a quantitative way the features that aid and hinder Passivhaus design. Where the vernacular features hinder Passivhaus design I will attempt to show design solutions that can fulfil the Passivhaus criteria whilst also adhering to any Local Authority Planning requirements.

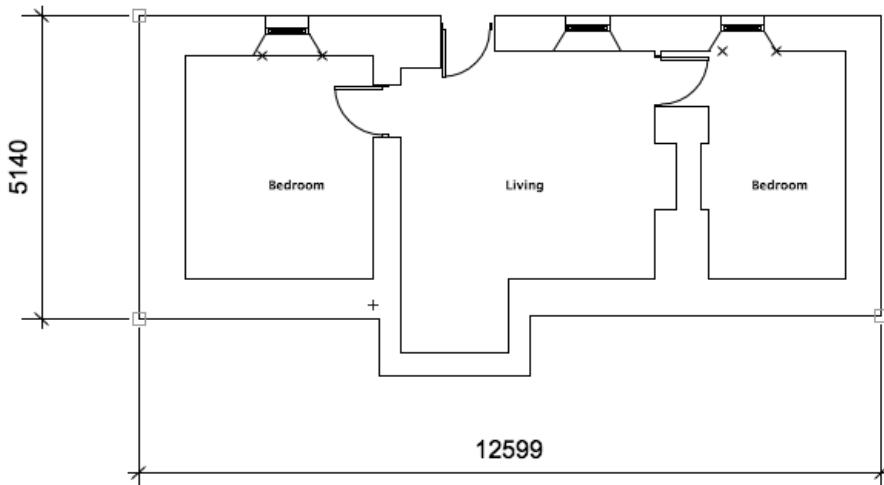
### **Irish Vernacular Design**

The typical Irish cottage that was built and continuously used between the mid-nineteenth and mid-twentieth centuries (around 1860-1960) witnessed the turbulent period when Ireland transformed from being part of the Union with Britain to an independent republic [McGarry 2017]. The typical design of this cottage together with explanation is shown below (Figure 1):



**Figure 1:** The traditional Irish cottage prevalent across the northern half of Ireland is characterised by a central living area which contained the principal cooking, eating and sitting space. This space contains a projecting ‘outshot’, which housed a bed. This central space is then flanked on either side by two bedrooms (drawing by Dr Marion McGarry and used with permission)

Therefore if we look at an actual example (surveyed by the author) we can see the following dimensions (Figure 2):



**Figure 2: Dimensioned drawing of plan of actual traditional Irish cottage, constructed circa 1930**

In detail the u-values of the fabric of the building would have been as follows. As you can see there would have been substantial heat losses through the walls and floors but the thatch has a u-value comparable to Irish construction standards in the 1990's

(Table 1).

	Construction	$\lambda$ Value [W/(mK)]	Thickness [cm]	u-value
Walls	Sandstone rendered both sides in lime	2.327	60	2.337
Floor	Stone flag floor	2.327	05	5.222
Roof	Thatch	0.09	30	0.288

- If we now look at the Heat Loss Form Factor using the following calculation:

$$\text{Heat Loss Form Factor} = \text{Heat Loss Area} / \text{Treated Floor Area}$$

$$\text{Treated Floor Area} = 39.8\text{m}^2$$

$$\text{Heat Loss Area (total surface area of the thermal envelope)} = 264.11\text{m}^2$$

$$\text{Therefore Heat Loss Form Factor} = 102.9\text{m}^2 / 39.8\text{m}^2 = 6.636$$

The Heat Loss Form Factor is a number generally between 0.5 and 5, with a lower number indicating a more compact building. Passivhaus buildings aim to achieve 3 or less. Once the Form Factor is over 3, achieving the Passivhaus Standard efficiently becomes noticeably more challenging. [Burrell 2015].

It is not surprising that the Heat Loss Form Factor is high; this is a combination of the building being detached, the low treated floor area compared to the surface area which

includes the high thickness of walls, the outshot projection and the thermal envelope at roof level. The building also confirms to the accepted generality that the larger the building the easier it is to achieve the Passivhaus standard.

### Rural House Design Guidelines - Form

Many Counties across Ireland now have Rural Design Guidelines. These started with the Cork Design Guide [Cork CoCo 2004] and were replicated on a County-by-County basis where the main concepts in rural house design were copied with specific local planning requirements also included. The example I will be referring to in this paper is the Mayo Rural Housing Design Guidelines published by Mayo County Council [Mayo CoCo 2008]

The principles of rural house design form in County Mayo can be summarised as follows:

- Narrow depth plan (typically around 6.5-7.5 metres in depth)
- The mass broken into several smaller forms rather than one large form (Figure 3) [Mayo CoCo 2008]:

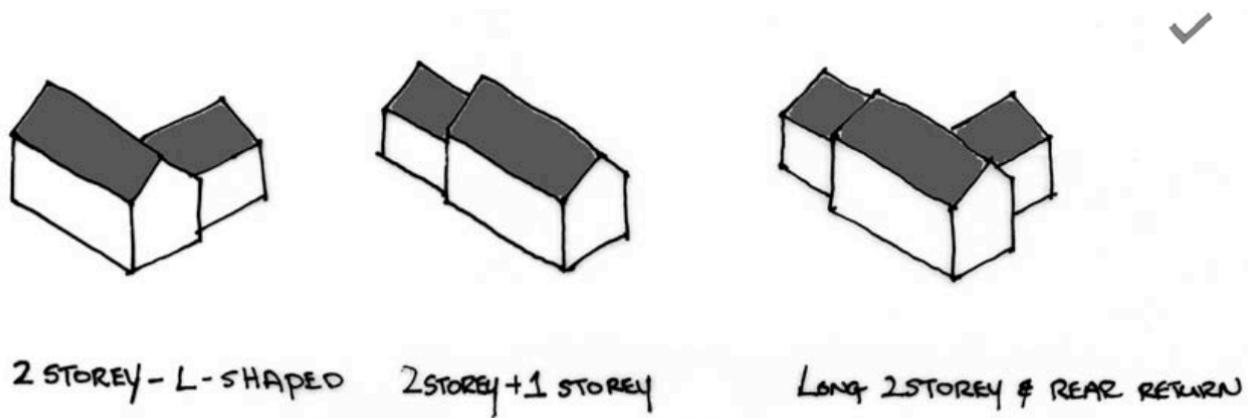


Figure 3: Mayo County Council guidelines on breaking larger mass down into several smaller forms [Mayo CoCo 2008]

### Contemporary Design solutions adhering to the rural house planning guidelines

Overleaf is an example of a project the author is currently designing that adheres to the Mayo County Council Rural House guidelines and was recently granted planning permission. (Figure 4):

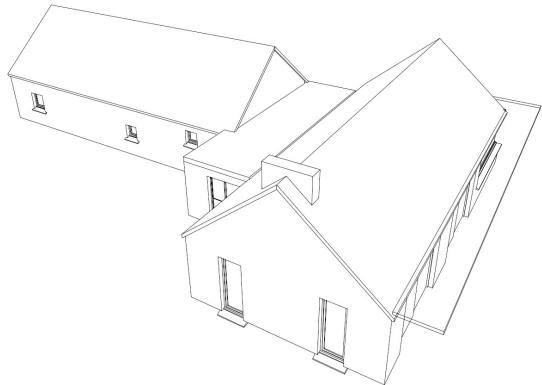
If we therefore prepare a similar Heat Loss Form Factor calculation we find:

$$\text{Treated Floor Area} = 173.9\text{m}^2$$

$$\text{Heat Loss Area (total surface area of the thermal envelope)} = 632.45\text{m}^2$$

$$\text{Therefore Heat Loss Form Factor} = 632.45\text{m}^2 / 173.9\text{m}^2 = 3.637$$

The increase in the Treated Floor Area (resulting in the increased size of house due to current living requirements) whilst retaining the same scale, proportions and geometry has resulted in an improvement in heat loss form factor of practically double



**Figure 4: 3D View of house design by author showing larger mass broken down into several traditional forms**

### Rural House Design Guidelines - detail

There are also several details required by Mayo County Council (which are similar to other Planning authorities across Ireland) that also need to be considered when aligning the planning requirements to a Passivhaus compliant dwelling. Many councils are cognisant now of the general Passivhaus principles of maximising solar gain to the principal living areas; some are also aware of the Heat Loss Form Factor and its importance in energy efficient design:

*“Organise the internal layout of the house to make best use of sunshine and daylight - locate the most used rooms on the south side and least used rooms to the north side. As well as reducing energy costs, sunny south-facing rooms have high amenity value. Try to minimise projections such as bay and dormer windows, which increase the surface-to-volume ratio of a building and thereby increase heat loss. They also tend to be more difficult to insulate effectively.”*

[Laois CoCo 2011] and

*“Select your Site & Locate your house to:*

*Maximise solar heat & light gain to living areas i.e. face Southwards.”*

[Mayo CoCo 2008]

It is fortunate that many rural design principles align directly with the Passivhaus criteria; in particular the requirement to adopt ‘simplified’ forms, materials and detailing greatly helps the requirement to detail with Thermal Bridge Free Design:

*“Simplicity of form and the use of a limited palette of materials, window types and roof features will ensure the finished house will merge rather than clash with the landscape.”*

[Laois CoCo 2011]

*"The general approach should be one of simplicity, avoiding over-elaboration of elevational treatments and using a restricted palette of details and materials."*

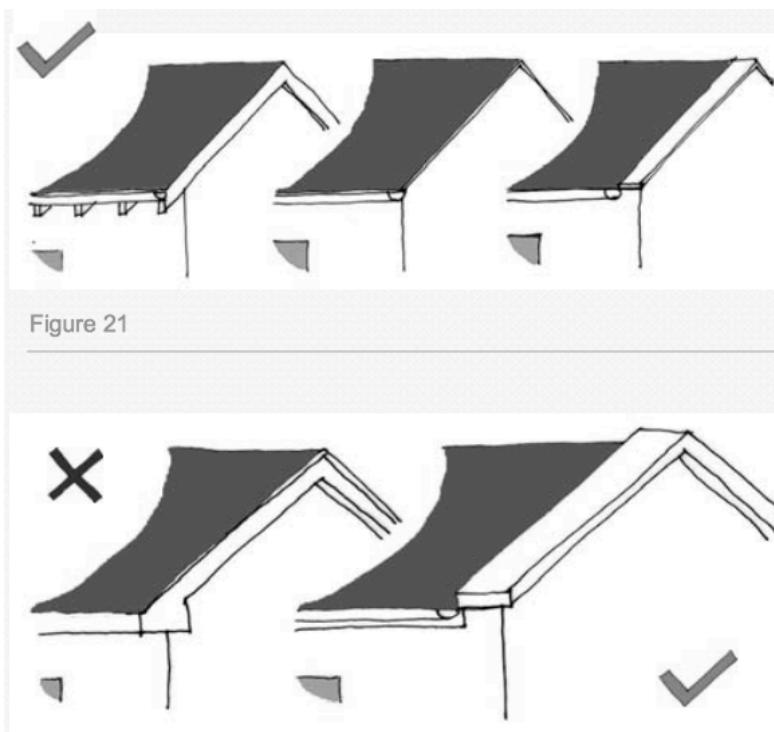
[Mayo CoCo 2008]

There are however a few areas that need to be carefully detailed in order to balance the rural house guidelines with the Passivhaus criteria. These are:

### 1. Roof detailing

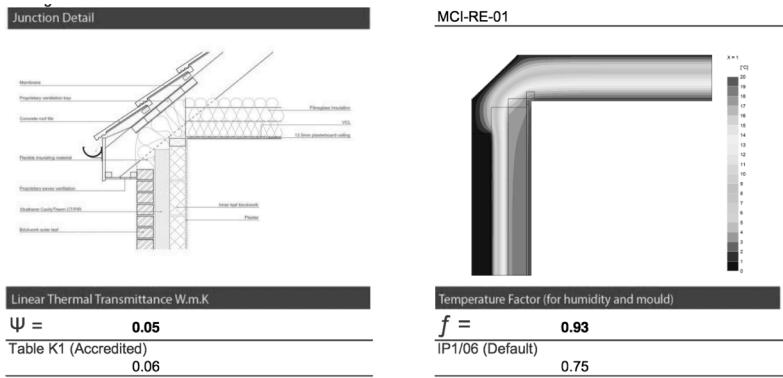
The diagram below (from the Mayo Rural Design guide [Mayo CoCo 2008] (Figure 5)) shows the ideal treatment of the junction between the gable wall and the roof. In essence the principles of simplicity of form result in either:

- A clipped eaves with a maximum 75mm soffit and fascia or:
- A 'concrete barge' detail that is a traditional detail that was used to hold down the thatch at the gables



**Figure 5: Mayo County Council guidelines on suitable roof to wall junction details [Mayo CoCo 2008]**

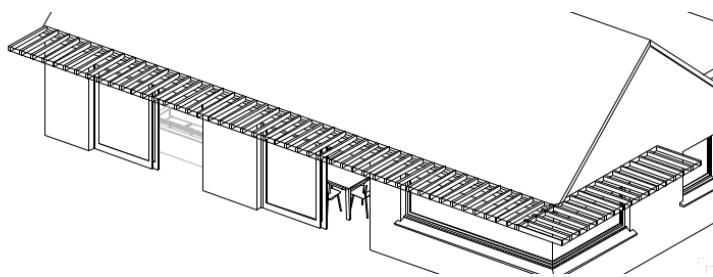
It is essential therefore that the thermal envelope is continuous and linked between the vertical wall and the roof and that any concrete barge is well above the thermal envelope so that it does not create a thermal bridge. The detail overleaf (Figure 6) shows an acceptable Thermal Bridge Calculation for this junction which would be typical in Ireland [Xtratherm 2012]



**Figure 6: Xtratherm Cavity Acceptable Construction Detail and Thermal Transmittance Calculation [Xtratherm 2012]**

## 2. Shading

The requirement to 'clip' back the eaves and soffit to 75mm means that the common method of having a 'deeper' eaves as a shading element to reduce overheating would not be acceptable.



This is why in our 'contemporary' traditional design we have kept this minimal soffit and have created a shading element in the form of a brise-soleil that is separate to the principal roof form.

## References

- [McGarry 2017] McGarry, Marion: *The Irish Cottage History, Culture and Design*  
ISBN: 978-1-78605-012-0
- [Burrell 2015] Burrell, Elrond; <https://elrondburrell.com/blog/passivhaus-heatloss-formfactor/>
- [Mayo CoCo 2008] Mayo County Council: Mayo Rural Housing Design Guidelines;  
<http://www.mayococo.ie/en/Planning/MayoCountyDevelopmentPlan2014-2020/Document2,24887,en.pdf>
- [Cork CoCo 2004] Cork County Council : Cork Rural Design Guide: Building a new house in the countryside ISBN: 0 9525 86940
- [Laois CoCo 2011] Laois County Council: Rural Housing Design Guidelines  
<http://www.laois.ie/wp-content/uploads/Appendix-7-Rural-Housing-Design-Guidelines.pdf>
- [Xtratherm 2012] Xtratherm: Acceptable Construction Detail  
<http://www.cavitytherm.com/wp-content/uploads/2016/09/XT-FF-E10-MCI-RE-01-0015-Certificate.pdf>

## **Page 7 – Short Summary at <200 characters**

This paper gives an historical background to Irish vernacular design in the context of the Irish cottage; the design, heat loss form factor and details for this and current rural house planning guidelines are examined and then reconciled so that the design meets the Passivhaus criteria.

Please attach a short summary of your contribution on **page 7 (poster page 3) of the document**. The summary must not be longer than **300 characters** (including spaces).

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