Alternate processes for determining fire safety methods in a historical building (cottage) using BIM software (Revit)

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Aim of the Project

The main aim of this dissertation is to investigate the implementation of modern fire safety features into an old historical building which in this case is a thatched cottage that has been converted into a café by using Building Information Modelling (BIM) software in this case Revit.

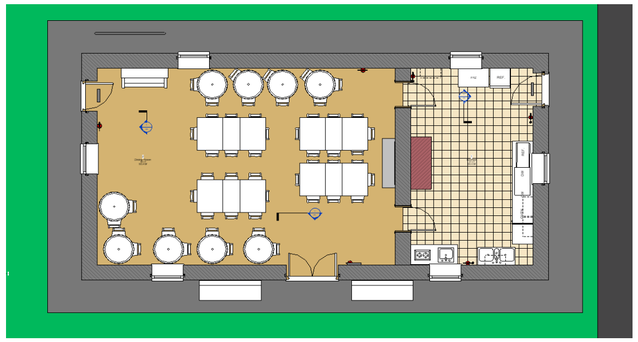
Background

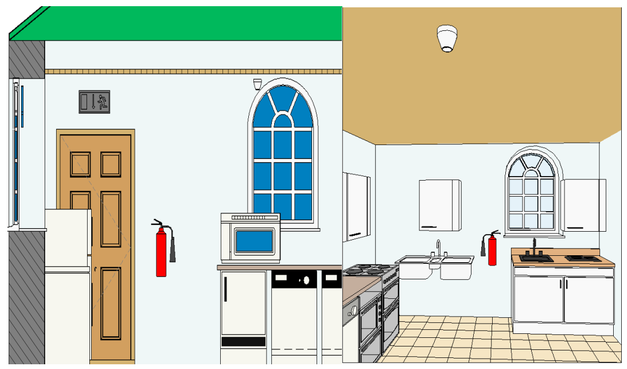
The researched material included the history of fire safety, fire safety in historical buildings, old cottages, building regulations in Ireland for fire safety, the history of building information modelling and they implementation of building information modelling into older buildings.

The cottages of antiquity have simple and classic design, typically they are designed to merge naturally with the surrounding countryside using native Irish building materials and mass construction practices, which is building heavy solid walls making the cottages outside layer to shield from the weather and acted as a load bearing frame to support the entire structure, the most commonly used building material was stone with a mortar with of sand and lime.

In Ireland, there is a set of legislations made out to keep all buildings that are constructed in Ireland remain at the same level of quality and safety.
They range from A – M but part B is the set of regulations that is very relevant to this study as it focuses on fire safety in dwellings.

Revit Modelling





A model of cottage which has been converted into a café was designed and created in BIM software (Revit). Next, modern fire safety features were implemented using Revit features which included fire extinguishers, fire blankets, alarms, sprinklers, smoke detectors and emergency exit signage.
BIM is a very adaptable tool for designing and implementing systems not just fire safety features but also plumbing, electrical and mechanical systems. This is due to the software that was used, Revit's large database which gives access to a wide range of different components that are responsible for making up a system.

Risk Assessment

Following this, a risk assessment was conducted on the buildings appliances and features that were deemed most likely to be involved in a fire and after this it was conducted again and compared with the pre changes results. The risk assessment deemed a 17% reduction in risk between pre and post changes.

Recommendations were then given based on the building regulations which involved keeping implemented exits clear of debris, keeping signage visible and clearly seen, conducting drills at least twice a year to make sure systems are functioning and keeping on top of the fire extinguisher lifespans.

It was deemed that the reduction in risk between the changes was not due to a decreased likelihood of a fire occurring but was related to a decreased degree of harm that would be likely to occur if a fire occurred due to the measures that were taken which overall are involved in the prevention a spread and suppression of fires.

LO (Likelihood of Occurrence)		
0.033	Almost impossible	Only in extreme circumstances
1	Highly unlikely	Though conceivable
1.5	Unlikely	But could occur
2	Possible	But unusual
5	Even chance	Could happen
8	Probable	Not surprising
10	Likely	To be expected
15	Certain	No doubt

FE (Frequency of Exposure)	
0.5	Annually
1	Monthly
1.5	Weekly
2.5	Daily
4	Hourly
5	Constantly

HRN	Risk
0-5	Negligible
5-50	Low, significant
50-500	High
Over 500	Unacceptable

HRN = LO x FE x DPH x NP

DPH (Degree of Possible Harm)	
0.1	Scratch or bruise
0.5	Laceration or mild ill-effect
2	Break of minor bone or minor illness (temporary)
4	Break of major bone or major illness (temporary)
6	Loss of one limb, eye, hearing (permanent)
10	Loss of two limbs or eyes (permanent)
15	Fatality

NP (Number of Persons at risk)	
1	1-2 persons
2	3-7 persons
4	8-15 persons
8	16-50 persons
12	50+ persons

Source: Filz Guide to Machinery Safety, 6th Edition

The above model displays the method behind a risk assessment in terms of the machinery/appliances that are situated in the kitchen of the café which includes the two dishwashers, gas cooker, cooker, freezer, refrigerator, and kitchenette hob. These components could also be at risk of overheating, especially due to the environment they operate in being a kitchen which is naturally going to be at a high temperature than average.

All the appliances will be run through the above model and after all parameters are met then a final risk priority number will be calculated based on the values gain in the other parameters. All appliances are being judged on how likely a fire could occur and what consequences could occur based on their operation before and after fire safety features are added.

Recommendations

The main recommendation for a future project or a continuation of this project would be a utilisation of a more rigid risk assessment model that is not as subjective as the one used in this study. The different parameters can be interpreted as being generalized and subjective because of terms like likely and unlikely which might not be as specific as needed for a risk assessment such as this.

Another recommendation would be utilisation of another BIM software to explore more facets of fire prevention and safety that deals with the evacuation process, fire growth, cost of damage, and other prevention strategies for example.

Finally, the last recommendation would be to take the study further not only conducting a risk assessment on a building but also to assess the viability and possible disadvantages of certain fire safety features. This could be done in a few ways: cost, reliability, adaptability, and effectiveness. This would give a more in-depth study that would give a lot of varying results.

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