

# BRE Client Report

## Relaxation of building regulations: spiral cellar, 7 Coltbridge Terrace, Edinburgh

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## 1 Introduction

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The Building Research Establishment (BRE) has been commissioned to carry out an assessment of an application for relaxation on building regulations. The application relates to Standard 4.4 'Pedestrian Protective Barriers'. The project concerns an alteration and extension to a property located at 7 Coltbridge Terrace, Edinburgh. The alteration and extension includes the construction of a wine cellar with spiral staircase.

The building warrant application has currently stalled as the verifier has not accepted the design as being compliant with building regulations. The following parties are relevant to the application:

- Applicant: Spiral Cellars Ltd
- Agent: Murdoch Architects
- Owner: Mr & Mrs Giles Cooke
- Local Authority Verifier: Edinburgh City Council.

This report includes an assessment of the issues involved, the design and relevant background documents; it also sets out conclusions. The report in itself is not a determination, which is a matter for Scottish Ministers, but instead can be used to assist the decision-making process.



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## 2 Review

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### 2.1 Documents supplied to BRE

#### 2.1.1 Structural calculations

This structural report has been prepared as part of the building warrant application. It states that the project involves the design and subsequent installation of a spiral wine cellar. The dominant forces are from water uplift pressures necessitating a minimum thickness of concrete foundation and walls of 150 mm. The drawings that are part of the report show a circular cellar of 2000 mm diameter, with a total excavation diameter of 2300 mm. The excavation depth from finished floor level is 2813 mm, giving a cellar depth of approximately 2500 mm.

#### 2.1.2 Spiral Cellars Ltd safety statement

This one page statement refers to safety concerns raised by the Local Authority Verifier, which are currently preventing the warrant from being issued. Three main points have been raised, as follows:

- Restricting access to the spiral cellar: the cellar doors have lockable systems in place.
- A physical and visual barrier: when open the door creates a physical and visual barrier, which takes account of door position relative to that of the cellar.
- Creating awareness that the door to the spiral cellar is open: an audible alarm and strobe is initiated once the door has been opened.

The statement concludes by stating that the cellar is a storage facility for wine and the door is only opened when stocking, perusing or removing wine. The time that it is open is therefore limited.

#### 2.1.3 Letter from Murdoch Architects to Scottish Government, BSD: 5 October 2015

This letter is in response to a request for further information on the application for relaxation. The following three points are made:

- Cellar door: opens so that the top step is closest to the window with the user facing back towards the room door when entering the cellar.
- Position: the cellar door is motorised and is operated by a fixed switch on the wall.
- Datasheet: door is constructed in timber pine frame with plywood insets, the intention is to create a seamless door with the floor finishes. The door is opened by a Linak motor, which can lift 2500 N. The door sits 900 mm above the floor when open.

#### 2.1.4 Design drawings

A number of design drawings have been made available to BRE. The cellar is shown within an office/study room at the front of the existing house. The overall room size is shown as approximately 3500 mm by 3150 mm overall on drawing 5-03 Revision C.

On the internal north wall (right hand side in drawing) the office/study door is located, which swings into the room. The east (bottom) wall has two windows and the south (party) and west walls have no openings.

The cellar is shown by two circles, the smaller of which has a 1400 mm diameter and the larger 2000 mm. The cellar door is shown as 1500 mm by 900 mm. It will open upwards towards the room access door. Anyone entering the room would need to manoeuvre to the left (east direction) if the hatch was open, as the room door would obstruct the other direction.



There is limited space shown to manoeuvre around the hatch door and then to access the stairs into the cellar.

## 2.2 Further information

### 2.2.1 Building Standard 4.4

Standard 4.4 is a mandatory requirement, which states the following:

“Every building must be designed and constructed in such a way that every sudden change of level that is accessible in, or around, the building is guarded by the provision of pedestrian protective barriers.”

The standard does not apply where the provision of pedestrian protective barriers would obstruct the use of areas so guarded.

The guidance to the standard, which is not mandatory, advises that protective barriers are necessary to prevent people in and around buildings from an accidental fall at an unguarded change of level.

In clause 4.4.1 it states that in the interests of safety, protective barriers should be provided where there is a sudden change in level and the possibility of severe injury from fall. The guidance continues by stating that it is not practical to provide a barrier at every change in level, but a protective barrier for pedestrians should be provided at the edge of:

Every floor, stair, ramp, landing, raised floor or other raised area to which people have access, where there is a difference in level of 600 mm or more.

The clause states that there is no need to provide a protective barrier in a location which would prevent intended access or be incompatible with the normal use of an area, such as to the edge of a loading bay.

The barrier should contrast with the surrounding areas, unless it is in a wall or partition.

The remaining clauses that are relevant to Standard 4.4 refer to design requirements of barriers. Reference is made to BS6399-1: 1996 with regards to the loads that are required to be carried.

### 2.2.2 Approved Document K (England & Wales)

Approved Document K has guidance that covers England and Wales and the requirements for protection against falling (note that although building regulations are devolved the document serves the same purpose).

Requirement K2 states the following:

- a. Any stairs, ramps, floors and balconies and any roof to which people have access, and
- b. Any light well, basement area or similar sunken area connected to a building.

Shall be provided with barriers where it is necessary to protect people in or about the building from falling.

The guidance states that for dwellings provide pedestrian guarding that is capable of preventing people from being injured by falling from a height of more than 600 mm. It further states that the standard for provision of guarding needed to give an acceptable level of safety depends on the circumstances. For example in a public building the standard may need to be higher than in a dwelling, because people may be less familiar with the building and there may be more users. Diagram 3.1 indicates that barriers within single family dwellings should be at least 900 mm high at edges of internal floors.



### 2.2.3 BS6399-1: 1996

This Part of BS 6399 gives dead and minimum recommended imposed loads for use in designing buildings. It applies to:

- a) New buildings and new structures;
- b) Alterations and additions to existing buildings and existing structures;
- c) Existing construction on change of use.

It does not apply to the maintenance of, or the replacement of parts of, existing buildings and structures where there is no change of use.

Table 4 of the standard specifies minimum horizontal imposed loads appropriate to the design of parapets, barriers, balustrades and other elements of a structure intended to retain, stop or guide people. The loads given in Table 4 should be treated as the un-factored or characteristic loads for design purposes.

The standard does not provide consideration of the design circumstances under which barriers are required in dwellings and other buildings.



### 3 Discussion

The building warrant application including the installation of a spiral stair cellar in a property at 7 Coltbridge Terrace, Edinburgh has been questioned by Edinburgh City Council's Building Standards Department. As a result an application for relaxation has been requested on behalf of the applicants. The issues concern the application and applicability of Functional Standard 4.4, which sets out the need to protect people where there is a sudden change of level that is accessible in or around the building.

The Spiral Cellar installation creates a circular hole within the floor with a total depth of 2.5 m. The guidance to Standard 4.4 states that a protective barrier for pedestrians should be provided where there is a difference in level of 600 mm or more, which includes at the edge of a floor.

The application for relaxation is applicable only to the circumstances in which the installation is being made, rather than being applicable to all installations of Spiral Cellars or similar types of installation. In this section of the report a number of particular aspects of the relaxation are considered.

#### 3.1 Requirements for pedestrian barriers

The guidance to Standard 4.4 in the Technical Handbooks, and further related guidance and standards is clear on the areas which should be protected and the design requirements. Pedestrian barriers need to afford protection against falling, and are thus of a height and strength that ensures protection. The design should also include aspects such as colour contrast and take account of the ability of young children to climb railings and other infill. Pedestrian barriers can be formed from different materials. Barriers would be expected to be permanent installations, where protection from a fall is always required.

It is noted that the requirements and the guidance within other UK regulations are similar to those in Scotland. In Approved Document K reference is made to the 600 mm difference in level and the barrier dimension of 900 mm height.

In a domestic setting the building regulations and associated guidance dominate the requirements for safety with regards to design and construction. In non-domestic buildings in addition to building regulations the Health & Safety Executive (for workplaces) and the Construction Design and Management regulations will also apply. These not only cover safety aspects of construction, but also the ongoing safety of the workplace.

#### 3.2 Design considerations

As stated above, the consideration must be to the actual installation rather than considering all Spiral Cellar or similar products. As shown on Spiral Cellars website, and indeed other similar companies, the actual installation can vary substantially. In some instances the open cellar door can be approached directly from a room door.

The installation at Coltbridge Terrace is stated to have the following items to mitigate risk of falling (set out in *italics*, with BRE comments in normal text):

- *Restricting access to the spiral cellar: the cellar doors have lockable systems in place: Position: the cellar door is motorised and is operated by a fixed switch on the wall:* In the closed position the door is locked, which will help to mitigate any opening by a person who is not responsible to do so. The second sentence may contradict the first, as it suggests that the door can be opened and released at the press of a button. The apparent contradiction between one aspect and another should be addressed by the designer, in particular the ability to restrict use is important for safety and security.





- *A physical and visual barrier: when open the door creates a physical and visual barrier, which takes account of door position relative to that of the cellar: Datasheet: door is constructed in timber pine frame with plywood insets, the intention is to create a seamless door with the floor finishes. The door is opened by a Linak motor, which can lift 2500 N. The door sits 900 mm above the floor when open:* This is one of the key points in mitigating against the risks involved. The door in the open position would prevent a person entering the room and walking / falling directly into the cellar. The design includes a wooden surface that would have colour contrast with the room surroundings. The main issue to consider is the resistance of the open door to collision with a pedestrian walking into the room. The door in the open position is forming a barrier on one side of the change of level, as such it should be capable of resisting loads as defined in BS6399-1.
- *Creating awareness that the door to the spiral cellar is open: an audible alarm and strobe is initiated once the door has been opened:* It is assumed that the alarms remain in place for the full duration of the door being open, as opposed to the period that it opens. The location of the light and sound need to be carefully considered in order to ensure that both those entering the room are warned and anyone inside the room.
- *Cellar door: opens so that the top step is closest to the window with the user facing back towards the room door when entering the cellar:* Once a person enters the room in order to access the open cellar they should be properly directed to the side with the steps. In the current design it is uncertain how this signage is or could be achieved, but it should be further addressed. As the spiral cellar installation is in a home industrial signage would not be reasonable. However, instructions on safe use of the spiral cellar for access and other aspects could be added to the underside of the cellar door. This would provide instruction on safe use, including advice for all users on access, opening times and behaviour around the open cellar door.

The above points (italics) were set out in design information and further correspondence from the applicant and their agents. The context of the room design should also be taken into consideration in protecting against the fall between levels. The room is relatively small, forming a home office, and when the cellar door is opened it will dominate the room.

The open position of the cellar door as designed means that three sides are opened. The cellar is entered only from one side. For those building users that are familiar with the entrance to the cellar this should not cause a problem. However, if an unfamiliar user was to enter the room then consideration needs to be given to properly directing them towards the entrance side.

Protection against unauthorised use may be achieved by having the room itself locked, and openable by a key or keypad. This would help to manage any future users of the building that may have small children.

### 3.3 Falls and accidents

BRE Report BR417 covered a wide range of health and safety issues in buildings as relevant to the requirements of building regulations. Slips, trips and falls within or from buildings are covered, particularly with relevance to falls on the level, stairs, ramps, balconies, roofs and windows. The reasons for falls vary depending on the item and the hazards involved. However, none of the areas covered particularly address the situation of the spiral cellar type of installation. The report does make clear that the consequences of accidents involving falls from height as opposed to on the level are more severe.

An internet search has not revealed any specific accident (in the public domain) concerning spiral cellars. A number of accidents are concerned with the falls into cellars under various scenarios within commercial buildings, particularly pubs and hotels.

Advice given in the Australian state of Victoria covers open trap doors for cellars in work environments. It states that a pedestrian was injured when she fell through the open trapdoor of a hotel cellar. The woman fell 2.7 metres and landed on beer barrels. She had life threatening injuries as a result.



The following advice is given:

- The risk of death or injury can be eliminated or reduced by:
  - Using an above-ground storage room instead of a below-ground cellar
  - Installing self-closing grill doors underneath the cellar trapdoor
  - Installing a built-in guard around the cellar trapdoor
  - Using temporary barriers such as chains or quick-assembly rails
  - Installing permanent barriers (such as a lockable door) around the cellar entrance
  - Locking the cellar trapdoor when not in use.

The Accident Helpline (UK) website states that the maintenance of such a room (cellar) is absolutely essential as it can have a serious knock-on effect on the safety of the rest of a home. The issues covered include water supply, ventilation, mould, exits and stocking. All these points would be relevant to a spiral cellar as well as larger cellars within homes. However, the guidance does not deal directly with any aspect of the falls from the floor level into the cellar.

### 3.4 Summary of issues

The design and construction of the spiral cellar at 7 Coltbridge Terrace, Edinburgh is the subject of a building warrant application. The creation of the cellar creates a situation where a fall from the floor from one level to another will be greater than 600 mm. The available guidance directs designers towards the use of suitable pedestrian barriers that protect people using the room from a fall.

The current design fails to provide guarding against a fall either in the form of a barrier or a grill over the opening. Such guards would impact on the ability to use the cellar and there would certainly need to be an opening gate on the side to which the cellar is accessed.

The spiral cellar situation is perhaps not 'atypical' of change of levels in buildings and in the specific circumstances of this property there are measures and design aspects that would mitigate the risks of users falling into the open cellar. The following points can, in particular, be noted:

- The cellar is within a small office room that is separated from the rest of the property by a door.
- The open door leaf would guard against anyone entering the room and falling directly into the open cellar.
- The use of audio and visual warnings (sounder and flashing light) would warn occupants that the door is open.
- The door is locked when closed.

Further measures and/or clarification would be advisable with regards to these safety aspects, including the following:

- Ensure that the office door is lockable, with access via a key or key pad, this will prevent entry by anyone other than those who understand the nature of the cellar and the risks involved.
- Add signage to direct users to the correct side for access to the cellar when entering the room and the door is open to the cellar. This could be achieved by adding instructions under the door surface, so that they can be read when the door is open.
- Ensure that the light and sound warnings continue for the duration of the time which the door is open, and to ensure that they are mains wired to prevent issues with batteries failing.
- Ensure that the door when closed is locked and cannot be opened other than by activation from a suitable user.

A further recommendation to mitigate risk would be to amend the design and construction in order to add a lightweight grill underneath to the inside (underside) of the door leaf.



The grill could be attached to the door leaf, but could be released and positioned over the opening in order to prevent falls if the door needs to be left open for any length of time. The grill when positioned for protection and its support should be capable of taking the weight of a person standing.



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## 4 Conclusions and recommendations

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BRE has undertaken an assessment of the matters involved in an application for relaxation from building regulations. In particular the relaxation involves a Spiral Cellar installation at a property in Edinburgh. Spiral Cellar is a proprietary design and construction of a small wine cellar that is intended for use in domestic buildings. The review has considered only the specific design and construction aspects of the property and does not imply any general opinion with regards to all Spiral Cellar installations, or other similar installations.

The following points are concluded:

- Standard 4.4 requires sudden changes of level to be guarded by the provision of pedestrian protective barriers. The design of the Spiral Cellar at 7 Coltbridge Terrace does not include full protection by a barrier on all four sides; although the opening cellar door will form such a barrier.
- The design does include various items, locks, alarms and the door leaf that mitigate against the risk of people falling into the cellar. Further design changes or safety enhancements can also be considered, however in the absence of a full permanent barrier there will always be some residual risk. The position of the cellar within the home will mitigate some of the risks, however a search of trade literature shows other types of installation that would raise further safety concerns particularly where people can walk through doors and immediately into a cellar that is unguarded.
- A review of the literature by internet searching did not find any specific cases of people falling into Spiral Cellars within their own home. However, there is ample reporting of accidents involving people falling into cellars through open doors, particularly in commercial pub and hotel premises. On the whole non-domestic premises would be considered at greater risk than domestic, but accidents resulting in death or severe injury do occur all too regularly within homes and efforts should be made to reduce the risks.
- Legislation and guidance from the HSE related to cellars and basements in work places are not entirely relevant to the home based situation that is the subject of this assessment.

Overall it can be concluded that the design of the Spiral Cellar at 7 Coltbridge Terrace could be fit for purpose even without a full permanent barrier, however, further design and safety enhancements and additions should be made to the existing design. The main recommendations made are as follows:

- Enhancements and clarifications:
  - Ensure that the office door is lockable, with access via a key or key pad, this will prevent entry by anyone other than those who understand the nature of the cellar and the risks involved.
  - Ensure that the light and sound warnings continue for the duration of the time which the door is open, and to ensure that they are mains wired to prevent issues with batteries failing.
  - Ensure that the door when closed is locked and cannot be opened other than by activation from a suitable user.
  - Ensure that there is sufficient space to negotiate around the open hatch after access the room. A minimum clear width of 600 mm should be sufficient for this purpose.
- Additions:
  - Add signage to direct users to the correct side for access to the cellar when entering the room and the door is open to the cellar. This could be added as safety instructions to the underside of cellar door to ensure that the user can read and be aware of the risks to themselves and to other building users. The instructions would include how to enter and leave the cellar as well as safe behaviour.



- Add a lightweight grill underneath to the inside (underside) of the door leaf. The grill could be attached to the door leaf, but could be released and positioned over the opening in order to prevent falls if the door needs to be left open for any length of time. The grill and its support when positioned for protection should be capable of taking the weight of a person standing.

The above recommendations do not constitute design guidance, but instead offer recommendations that could be used in revising the design.

Any other Spiral Cellar installations, or similar installations, would need to be considered on their own merits rather than being based on the findings of this review and its conclusions.