The Royal Society for the Prevention of Accidents

accidents don't have to happen

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Safer by design

A framework to reduce serious accidental injury in new-build homes

Edition One

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Foreword

Too many people are killed or seriously injured in accidents in the place where they should feel the safest – their home. Indeed, more lives are lost as a result of accidents at home than in any other setting, and it is the most vulnerable in our communities – young children, older people and those who are poor – who are affected most greatly. This framework provides a positive response to such a stark reality.

It aims to reduce the huge accidental injury burden on individual families, the health and social care sector and society as a whole, by prioritising evidence-based recommendations for simple home safety improvements. I commend this document to all who are involved in planning for new homes, whether in the private or social housing sectors.

Its wide-scale adoption would make a significant contribution to improving the safety of homes across our nation.

Baroness Jolly
RoSPA President

Introduction

Safer by design: A framework to reduce serious accidental injury in new-build homes is RoSPA's response to the fact that, with more than 6,000 people killed as a result of a home accident in the UK every year, the home is arguably the most dangerous place to be.

Those most vulnerable to serious accidental injury in the home are very young children and older people, with poverty being a significant influencing factor.

Yet home accidents can be prevented, with a blend of interventions focusing on education, engineering/environment and enforcement – the "three Es" of prevention – being traditionally implemented to this end. Of these interventions, the importance of safer environments cannot be overstated, which is why the provision of homes that are "safer by design" was among 25 recommendations in *Safe and active at all ages: A national strategy to prevent serious accidental injuries in England* (RoSPA, 2018).

By drilling down to understand the causes of accidental harm in the home, and taking steps to mitigate these where the need for action is greatest, we can create physically-safer homes, which meet the present and future needs of those who live in them – providing environments that support young children in having the best start in life while also promoting healthy ageing and independence in later life.

For every fire-related hospital admission, there are 234 due to falls

Large-scale tragedies – most recently the appalling fire at Grenfell Tower in 2017 – quite rightly turn people's attention to how such awful events can be prevented from ever happening again. As in the case of Grenfell Tower, there is often a swift national response to these tragedies through public inquiries and other investigations, and sometimes there are subsequent changes to the regulatory environment.

"We're confident that it is commercially, and technically, viable for us to achieve Gold standard."

Barry Oliver
Corporate executive for health and safety, Berkeley Group

Quite deliberately, this framework concentrates on the mitigation of hazards that typically do not attract the same level of public scrutiny and for which the regulatory landscape is less developed compared to other hazards, such as fire. It covers various hazards associated with the greatest likelihood of occurrence in new homes, an approach which is outlined in more detail in the Methodology section on page 4. The types of accident covered here – falls, burns, carbon monoxide poisoning, entrapment and poisoning from household chemicals – often go unnoticed publicly because they happen behind closed doors, and yet they each affect many thousands of people through death and serious injury every year.

The framework provides a set of simple, low-cost home safety improvements, developed in consultation with industry experts, to be planned in at the design stage. Prioritised according to a statistical evidence base, and going beyond current building regulatory requirements, these recommendations are, crucially, commercially and technically viable within both the private and social housing sectors.

"RoSPA's framework aligns with our need to build age-neutral properties that can meet the changing needs of transient residents"

Jayne Lombardi
Head of health, safety and insurance, Orbit Homes

Methodology

The Decent Homes Standard (DCLG, 2006) uses the *Housing Health and Safety Rating System* (ODPM, 2006) as the statutory element to assess homes across a variety of hazards and to determine the potential risk of harm from these hazards; this methodology is based on a number of reports commissioned by government, the latest of which was entitled the *Review of Health and Safety Risk Drivers* (DCLG, 2008). The methodology has also been used to determine the cost of the poorest housing in the housing stock, and the potential benefits to society of reducing the risk of harm, with a series of reports from BRE (Roys et al, 2016). This methodology works well with the poorest housing, since the relative risks are high. However, as the housing stock improves with newer housing requiring adherence to safety requirements through the building regulations, the potential benefit diminishes. There are some building-related hazards that are still prevalent in newer housing built to current building regulations, either because the hazard isn't addressed or because the risk of harm is still too high.

Using the potential-for-harm values for modern housing built to 2010 building regulations found in BRE report *The full cost of poor housing* (FB81) (Roys et al, 2016), the hazards where the likelihood of occurrence is greater than 1 in 5,000 were considered for inclusion in this framework. From these hazards, only those relating to safety hazards, rather than long-term health effects, were selected. The extent of the risk in new-build homes is determined by considering the proportion of the housing stock built since 2010, and applying the risk-potential ratio from FB81 (2010 likelihood/average likelihood) to the harm calculation.

The risks in this framework relate to nine hazards. Five hazards are falls related – falls on internal stairs, falls on external stairs, falls on the level, falls between levels and falls in bathrooms. The other hazards relate to carbon monoxide poisoning, entrapment with doors and contact with hot surfaces, with the ninth hazard, poisoning from household chemicals, also being included because it can easily be tackled by design.

Each hazard is addressed in turn over the coming pages. In each section, there is a summary of the statistical significance of the hazard, followed by a table of related design criteria that could be employed to reduce the risks from these hazards, all of which go beyond current building regulations to deliver additional safety measures.

This framework aims to encourage safer design choices for the planned housing stock – so if a three-storey town house is planned, it will ensure that it is a *safer* three-storey town house. Points are accrued for every safety modification adopted, with more points equalling a higher grade. A higher grade is therefore a reward for adopting more of the framework's recommendations. The framework is not intended to be used to compare different housing types – for example, it does not support a comparison of the relative safety of a three-storey town house with that of a bungalow. Those working towards the framework will also need to ensure that any criteria they adopt to make properties safer in relation to the hazards addressed here do not impact negatively on other aspects of safety that are covered by building regulations.

Points are gained for the design criteria adopted, with additional points (+ points) also available for some features. For example, the table on page 6 shows that 10 points are available for a design incorporating step dimensions that meet the guidance in BS5395-1:2010. However, 5 + points can be gained if the minimum going is increased further to 275mm, or 10 + points for an increase to 300mm. These additional 5 or 10 points are + points because they are only applicable if the initial 10 points were first achieved. On page 6, minus (-) points are awarded for one type of step design, because it is deemed a particular risk, but it is then possible to accrue + points for design features that mitigate the risk.

The colour-graded bar at the end of each section shows the total amount of points available and, as this framework is graded into Silver, Gold and Platinum, it also shows the boundaries between the three standards. The overall score sheet on page 17 summarises these and shows what the framework as a whole is marked out of, and what score is required for each of the three standards (both as a total and as a percentage). An example is also included, which demonstrates how a dwelling could comfortably achieve Gold Standard.

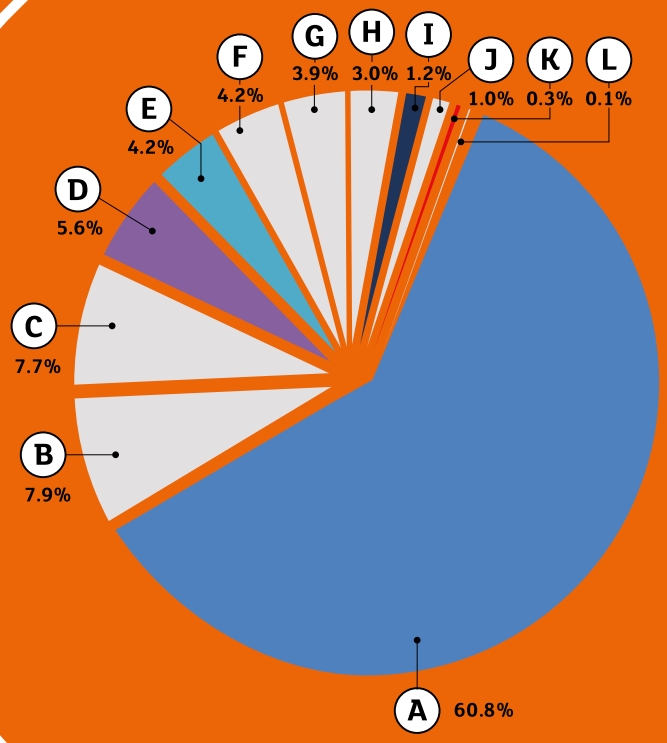
Assessed at the design stage, via the completion of a scoring matrix, organisations will be awarded a logo, along with conditions for use, which corresponds to the score their dwellings have achieved, as well as a certificate for the entire development.

ROSPA
Safer by design
Silver Standard Home

ROSPA
Safer by design
Gold Standard Home

ROSPA
Safer by design
Platinum Standard Home

All three levels go above current regulatory requirements, and are therefore significant achievements. The Platinum Standard is intended as a future driver of best practice across the new-build sector and provides an important element of challenge to work towards.



Hospital admissions due to accidental injury, England 2017/18

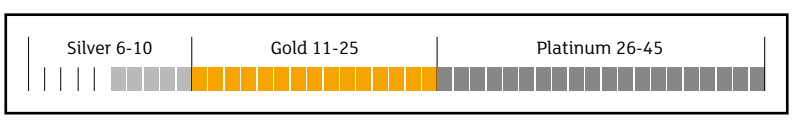
A: Falls
B: Other
C: Transport
D: Striking, crushed, jammed
E: Accidental poisoning
F: Contact with sharp objects and machinery
G: Bitten, struck or stung by a person, animal or plant
H: Discharge from guns, fireworks, explosions etc
I: Burns from contact with hot substances & objects etc
J: Drowning, asphyxiation & suffocation
K: Exposure to fire, smoke and flames
L: Exposure to electricity, radiation, light and heat

Internal dwelling stairs

The problem

Falls on steps and stairs are a leading cause of accidental death in the home, with at least 700 people dying as a result of falling on domestic stairs every year. The risk on stairs built to current building regulation guidance remains high. It is estimated that, annually, more than 30 deaths will occur on stairs built since 2010, with 1,000+ hospital admissions and 14,000 injuries leading to A&E attendance. Many of these risks could be reduced by better design. Following the guidance given in BS5395-1:2010 for "private stairs" (BSI, 2010) should reduce the risk of falls.

Design criteria	Points available
All dwelling rooms on one level (no internal stairs)	10
Step dimensions meet the guidance in BS5395-1:2010	10
• Going between 250-400 mm	
• Rise between 150-200 mm	
• 1% tolerance on dimensions	
• Centre going on winders, if present, equal to going on straight flights	
• Minimum going increased to 275 mm	+5
• Minimum going increased to 300 mm	+10
Handrails meet guidance in BS5395-1:2010	3
• Top of handrail to be between 900-1000 mm above pitch line or floor	
• Height above pitch line equal throughout whole flight	
• Two handrails – one on each side of straight flights	+2
• At least one handrail must be graspable	+3
Minimum clear width meets guidance in BS5395-1:2010	3
• Minimum clear width at handrail height 800 mm	
• Minimum clear width at handrail height increased to 900 mm	+2
Short flights of one or two steps adjacent to a winder flight or landing	-5
Where necessary they should meet the guidance in BS5395-1:2010	+3
• At the foot of a main flight only	
• Rise and going dimensions match the rest of the main flight	
• At least one handrail for the short flight	+2
Lighting meets guidance in BS5395-1:2010	2
• Two-way switching for artificial lighting at the top and bottom of flights at each floor	
• Windows located on stairs situated such that normal operations can be performed safely	
• Localised LED lighting illuminating alternate steps when dark	+3
Provision for addition of stair safety gates	2
• Solid areas in walls for the secure mounting of safety gates at top and bottom of flight	
• Information in handover book showing location	
• Landing design at top of the flight to enable stair gates to be fixed a minimum of 800 mm clear of the flight or at 90° to the last step	+5



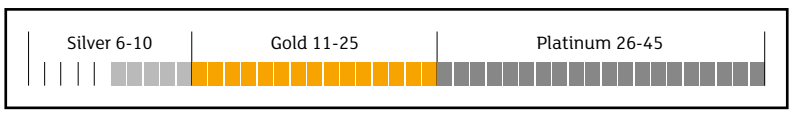
A 90-year-old man with dementia and his wife both died after a fall down the stairs at their home

External and communal stairs

The problem

The majority of the estimated 30+ deaths that will occur annually on stairs built since 2010 will occur on internal stairs; however, the risks on external and communal stairs could also be reduced by better design. Following the guidance given in BS5395-1:2010 for "normal stairs" (BSI, 2010) should reduce the risk of falls.

Design criteria	Points available
Step-free access to the whole of plot	10
Step-free access from main door to the dwelling unit	10
External step dimensions meet the guidance in BS5395-1:2010	5
Communal step dimensions meet the guidance in BS5395-1:2010	5
• Going between 300-450 mm	
• Rise between 150-180 mm (maximum 20 rises per flight)	
• 1% tolerance on dimensions	
• Suitable step profiles	
• Contrasting nosings	
• Minimum going for communal stairs increased to 325 mm	+5
• Minimum going for external stairs increased to 325 mm	+5
Handrails meet guidance in BS5395-1:2010	5
• Top of handrail between 900-1000 mm above pitch line	
• Top of handrail 1100 mm above landings and floors	
• Height above pitch line equal throughout whole flight	
• Handrail extends at least 300 mm beyond top and bottom nosings	
• Handrail height on flight 1100 mm minus the rise height	+2
• Handrail levels off for landings and floors at bottom nosing and one going beyond top nosing	+3
Minimum clear width meets guidance in BS5395-1:2010	3
• Minimum clear width between handrails 1000 mm	
• Minimum clear width between handrails increased to 1200 mm	+2
Lighting meets guidance in BS5395-1:2010	+2
• Two-way switching for artificial lighting at the top and bottom of flights at each floor	
• Windows located on stairs situated such that normal operations can be performed safely	
• Emergency lighting on communal stairs in accordance with BS5266-1	
• Localised LED lighting illuminating alternate steps when dark	+3
• Continuous localised LED lighting illuminating alternate steps	+8



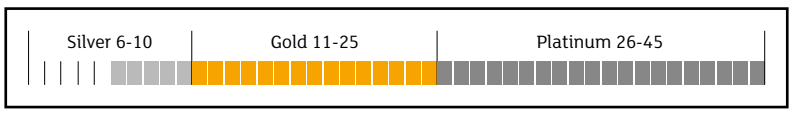
Falls are the largest single cause of accident-related A&E attendance

Floors and steps

The problem

Falls on level surfaces result in 124 deaths, 48,600 hospital admissions and more than 600,000 A&E attendances per year. It is estimated that, annually, more than five deaths will occur from such falls in homes built since 2010, with a further 1,800+ hospital admissions and 23,400 injuries leading to A&E attendance. Where changes in level are needed, but the change is less than 540 mm, short runs of one or two steps may occur. These should be avoided wherever possible but might be required on sloping sites. Many of the risks of falls on floors and short runs of steps could be reduced by better design (Roys, 2007).

Design criteria	Points available
Step-free access to the building via all doors and at balconies	10
Step-free access to all rooms on each storey	10
Where step-free access to the building is not possible, steps to the building at door thresholds or balconies meet the guidance in BS5395-1:2010	5
• Rise between 100 mm and 180 mm (no more than three rises)	
• Going on steps between 300 mm and 450 mm	
• 900 mm landing/path at the top and bottom of steps over the full width of the steps or door opening	
• Handrails or grab-rails for steps	+5
Where step-free access to all rooms on each storey is not possible	5
• All one- or two-step changes in level (either between rooms or within a room) demarked with a contrasting floor finish	
• Handrails or grab-rails for steps	+5
Flooring that has a slip test certificate in potentially wet internal areas	2
• UK Pendulum test value (PTV) of 27+ in wet conditions or DIN 51130 R10 rating[1]	
• UK Pendulum test value (PTV) of 29+ in water wet conditions	+3
• UK Pendulum test value (PTV) of 36+ in water wet conditions	+8
• Flooring that has a slip test certificate in external walkways and balcony areas	10
UK Pendulum test value (PTV) of 36+ in water wet conditions or DIN 51130 R11 rating[2]	
• Permeable external paving materials for all walkways to reduce the build up of surface water or ice	+5



In the 10 years since 2008, there has been a 71 per cent increase in falls-related fatalities for the over-65s in Scotland

[1] DIN 51130 test is not equivalent to the UK Pendulum. An R10 rating could provide a typical PTV between 19 and 34. Values as low as 15 and as high as 64 have been recorded against R10 flooring.

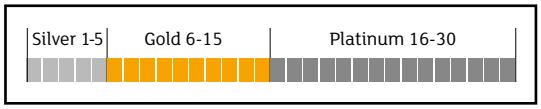
[2] DIN 51130 test is not equivalent to the UK Pendulum. An R11 rating could provide a typical PTV between 34 and 50. Values as low as 22 and as high as 60 have been recorded against R11 flooring.

Bannisters and guarding

The problem

Falls between levels can be highly emotive because they tend to affect young children. Each year, they account for more than 80 deaths and more than 54,000 visits to A&E, 4,000 of which are likely to result in hospital admissions. It is estimated that, annually, one death will occur from such falls in homes built since 2010, with 50+ hospital admissions and 700 injuries leading to A&E attendance. Many of these risks could be reduced by better design.

Design criteria	Points available
Restrictor which limits the opening to 100 mm on all windows above ground-floor level • Mechanism must be easily overcome by an adult if intended as an alternative means of escape (e.g. in the event of fire)	5
Balcony doors restricted to prevent opening by children under 5 years of age • Mechanism must be easily overcome by an adult if intended as an alternative means of escape (e.g. in the event of fire)	5
Glass used in guarding to meet 2(B)2 classification under BS EN 12600	5
1250 mm guarding height to external balconies and edges of accessible roofs	5
1100 mm guarding height to internal floors, landings and ramps	5
1100 mm guarding height to stair flights • Minimum 800 mm clear width at handrail height • Separate handrail required as the handrail will no longer be able to form the top of the guarding	5



A six-year-old boy fell from a window and died while reading a book. It's thought he was sitting on the sill and leant against the window

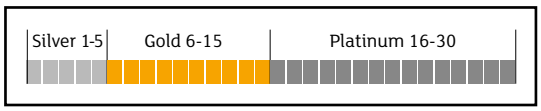
265 under-fives were admitted to hospital in England having fallen from a building in 2017/18

Bathrooms

The problem

The number of falls in bathrooms is very similar to falls between levels, with more than 80 deaths and more than 54,000 visits to A&E, 4,000 of which are likely to result in hospital admissions, each year. It is estimated that, annually, three deaths will occur from such falls in homes built since 2010, with a further 160+ hospital admissions and 2,000 injuries leading to A&E attendance. Many of these falls relate to transference into and out of the bath or shower, loss of balance within a bath or shower, or from standing after using a toilet.

Design criteria	Points available
Sanitary facilities meet requirements of AD M4(2)	5
• Guidance on suitable location for grab-rails and handrails in handover pack	+5
• Building in line with Category 2 requirement for accessible and adaptable dwellings M4(2)	+10
Baths and shower bases have a slip test certificate • UK Pendulum test value (PTV) of 27+ in water wet conditions using slider 55 or DIN 51097 Class A rating[3]	2
• UK Pendulum test value (PTV) of 29+ in water wet conditions using slider 55	+3
• UK Pendulum test value (PTV) of 36+ in water wet conditions or DIN51097 Class B rating[4]	+8



A 76-year-old man was left lying in agony in his bathroom for four hours when he suffered a broken hip and shoulder following a fall

[3] DIN 51097 is not equivalent to the UK Pendulum. A Class A rating could provide a typical PTV between 21 and 32.

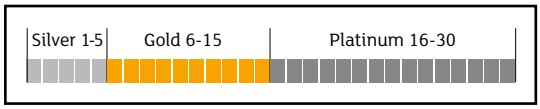
[4] DIN 51097 test is not equivalent to the UK Pendulum. A Class B rating could provide a typical PTV between 33 and 45.

Hot surfaces

The problem

Burns from hot surfaces account for about four deaths, 1,700 hospital admissions and about 22,000 A&E attendances each year. For housing built since 2010, there are likely to be about 800 cases of injury per year. However, burns can be life-changing events requiring ongoing medical treatment with victims scarred for life.

Design criteria	Points available
Provision for addition of fire guards • Solid areas in walls for the secure mounting of fire guards around fires/stoves • Information in handover book showing location	5
Reduce potential of burns in kitchens • Induction hobs in kitchens	5
• Ovens at mid height	5
Reduce potential for contact with hot surfaces for central heating • Low-temperature heating systems or under-floor heating systems	10
• Guidance in handover pack to enable efficient and appropriate use of alternative central heating systems	+5

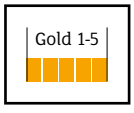


Carbon monoxide

The problem

The number of injuries caused by combustion products is difficult to determine with accuracy. Using the ICD code X47 - Accidental poisoning by and exposure to other gases and vapours, there are 22 deaths in the home, 530 hospital admissions and nearly 7,000 A&E attendances each year. These numbers will include poisoning from gases and vapours other than carbon monoxide. It is estimated that, each year, there will be fewer than 100 incidences of carbon monoxide poisoning in homes built since 2010.

Design criteria	Points available
10-year battery-operated or fixed-wire CO alarm in all rooms that have a fixed solid, gas or liquid fuel-burning appliance installed • Alarm meets the requirements of BS EN 50291:2001 • Fixed to the ceiling at least 300 mm away from a wall • Information in handover book showing location and guidance on maintenance/replacement	5



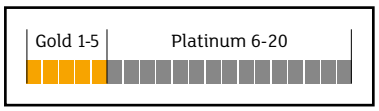
"If we hadn't had an alarm we would have been dead within three hours"

Entrapment

The problem

The number of injuries caused by entrapment in doors is difficult to determine with accuracy. Using the ICD code W23 - Caught, crushed, jammed or pinched in or between objects, there are two deaths, more than 7,000 hospital admissions and more than 95,000 A&E attendances each year. These numbers will include collisions involving other objects, both freestanding and those which are part of the building fixtures. It is estimated that, each year, there will be slightly more than 4,000 incidents of entrapment in homes built since 2010.

Design criteria	Points available
Fewer doors through open-plan designs, while ensuring that active or passive fire safety measures are not compromised	5
Dampeners on doors, including fire doors	10
Alternative door designs e.g. pocket doors, while ensuring that active or passive fire safety measures are not compromised	5

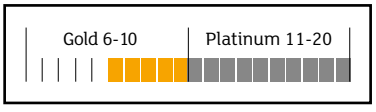


Poisoning

The problem

The number of poisonings by household chemicals or medication is difficult to determine with accuracy. Using the ICD code W49 – Accidental poisoning by and exposure to other and unspecified chemicals and noxious substances, and ICD codes X40-X44 – Accidental poisoning by and exposure to specified and unspecified drugs, medicaments and biological substances, there are more than 3,500 hospital admissions and more than 46,000 A&E attendances involving children under the age of five. These numbers may include poisonings from other chemicals not normally considered as household products. It is estimated that, each year, there will be slightly more than 2,000 incidents of poisoning by household chemicals in homes built since 2010.

Design criteria	Points available
Reduce potential for poisoning from household chemicals • Lockable high-level cabinet in kitchen • Information in handover book showing location and guidance on use	10
• Additional lockable cupboards in the kitchen or utility room	+5
Reduce potential for poisoning from drugs and medication • Lockable high-level cabinet in bathroom • Information in handover book showing location and guidance on use	5



On average, 15 under-fives are admitted to hospital every day due to suspected poisoning. Most accidental poisoning happens to children younger than five years old, with children aged one to three being most at risk

Overall score sheet

The following tables show the number of points available, and how these equate to the Silver, Gold or Platinum standards.

Standard	Number of points required
No Grade	**1-20**
Silver	**21-50**
Gold	**51-140**
Platinum	**141-270**

Design criteria	No Grade	Silver	Gold	Platinum
Internal dwelling stairs	1-5	6-10	11-25	26-45
External and communal stairs	1-5	6-10	11-25	26-45
Floors and steps	1-5	6-10	11-25	26-45
Bannisters and guarding		1-5	6-15	16-30
Bathrooms		1-5	6-15	16-30
Hot surfaces		1-5	6-15	16-30
Carbon monoxide			1-5	
Entrapment			1-5	6-20
Poisoning		1-5	6-15	16-20
Total number of points available	1-20	21-50	51-140	141-270
Total points as a percentage	**1-7%**	**8-18%**	**19-52%**	**53%+**

Example of Gold Standard Home:

Design criteria	Score	Standard
Internal dwelling stairs	18/45	Gold
External and communal stairs	18/45	Gold
Floors and steps	22/45	Gold
Bannisters and guarding	0/30	-
Bathrooms	12/30	Gold
Hot surfaces	10/30	Gold
Carbon monoxide	5/5	Gold
Entrapment	0/20	-
Poisoning	10/20	Gold
Total	**95/270**	**= Gold**

Adopting the framework

Safer by design: A framework to reduce serious accidental injury in new-build homes focuses on designing out the causes of the most prevalent home accidents and injuries. The recommendations are achievable, and deliver real-world benefits.

> ***"We rightly work incredibly hard to keep people building our new homes safe. Adopting this framework helps us keep those living in our homes safe too."***
>
> **Karl Whiteman**
> Executive director, Berkeley Group

Across the nine priority areas, points accrue for every safety modification adopted. The more safety measures employed, the higher the score. For example, designs with step dimensions that meet the guidance in BS5395-1:2010 gain 10 points (see page 6), and those that provide a lockable high-level cabinet in the kitchen, and information in the handover book showing the kitchen location and guidance on use, gain a further 10 points (see page 14).

In turn, more points equals a higher grade, with 21 points gaining Silver, 51 Gold and 141+ achieving Platinum. All dwellings within a development must be scored (using the simple online form), and one overall grade is assigned per development – not one grade per dwelling type. To achieve a grade, a "meaningful majority" (90 per cent) of dwellings within the development must meet that level (e.g. if 80 per cent of dwellings achieve Gold, and 20 per cent achieve Silver, the development overall will be awarded Silver; if 90 per cent of dwellings achieve Gold, and 10 per cent achieve Silver, the development overall will be awarded Gold).

For a grade to be recognised, additional documentation in the form of plans and elevations must be submitted, and an administrative fee paid (full details on the website). RoSPA will assign a grade (Silver, Gold or Platinum) based on the information received, and will issue certificates and logos along with guidelines for use, accordingly.

New-build homeowners

By encouraging architects and developers to design out key risks, this framework plays a major role in keeping homeowners of all ages and stages of life from serious accidental harm. To complement and further increase its effectiveness, RoSPA can also provide safety awareness and education materials to be included in handover packs or even displayed in communal areas.

> ***"Orbit Homes is proud to have adopted this framework for the new homes we build and those we commission to be built by others. It is perfectly aligned to our vision and values, that ensure we provide quality, well-designed new homes of all tenures in thriving, and very importantly, safe communities."***
>
> **Helen Moore**
> Managing director, Orbit Homes

To find out more, and to get involved:

Visit **www.rospa.com/built-environment**
Email **partnerships@rospa.com**

References

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Data note

The injury data used in this framework is for England. Mortality figures are based on the Office for National Statistics' "deaths registered" dataset, and hospital admissions on NHS Digital's Hospital Episode Statistics for admitted patient care. Detailed A&E attendance figures for accidental injury are not currently available, so the A&E estimates in this document have been calculated by comparing the UK's Home Accident Surveillance System 2002 (which remains the most comprehensive set of accident-related A&E data) with the more recent Hospital Episode Statistics for England.

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