Standard specifications, layouts and dimensions

6 SIX

Internal stairways in schools

department for
children, schools and families

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Contents

Introduction

This guidance is one of a series of Standard Specifications, Layouts and Dimensions (SSLD) guidance notes produced to inform the Building Schools for the Future (BSF) programme.

Who is this guidance for?

- Teachers and governors acting as clients for school capital projects
- Local authority officers responsible for procuring school capital projects
- Diocesan Building Officers
- Local authority and private sector school designers and specifiers
- Manufacturers and suppliers
- Contractors

How the guidance should be used

This guidance sets out the standards of performance for internal stairways in schools and shows how these standards might be delivered through some design examples. The aim is to disseminate best practice and avoid 'reinventing the wheel' every time a school building is designed, so that consistently high quality environments can be delivered, offering best whole-life value for money.

School building clients, their professional advisers, contractors and their supply chains should use the guidance to inform their decisions on internal stairs and specification standards at the early stages of a project's development – whether new build, extension or refurbishment – at RIBA Stages A-F.

To help encourage the take up of these performance specifications and design examples, this guidance will become the standard in BSF programme documentation and the Government will expect it to be adopted in the majority of situations where it is reasonable and appropriate to do so. While we would expect projects to comply with the standards, other solutions – possibly based on new products or technologies, or reflecting local factors – may equally comply with the performance specification and could be used. We do not want to stifle innovation by being too prescriptive.

It is for users to exercise their own skill and expertise in deciding whether a specification or example shown in this publication is reasonable and appropriate for their circumstances. The guidance here does not affect obligations and liabilities under the law relating to construction and building.

Though principally aimed at secondary school building projects delivered through the BSF programme, the specifications and solutions may also apply to other educational buildings.

We will keep this guidance under review and update it as necessary to reflect the development of new products, processes, and regulations. A web-based version is available at: www.teachernet.gov.uk/schoolbuildings

Background to Standard Specifications, Layouts and Dimensions (SSLD)

The BSF programme offers a unique opportunity over the next 10-15 years to transform our secondary schools, providing innovative learning environments that will inspire pupils to achieve more. High quality, modern school buildings will help to raise standards and play a crucial part in the Government's programme of educational reform.

With the huge increases in funding associated with this programme, there is considerable scope for using standardised specifications, layouts and dimensions to speed up design and construction, reduce whole-life costs and deliver consistently high quality and better value school buildings. Standardisation will support the use of more off-site fabrication and modern methods of construction, which should help to improve health and safety performance, reduce waste and deliver more sustainable solutions. For the supply industry, being involved in standardisation will help to demonstrate market leadership – and help firms reduce risk and increase sales, profitability, and market size.

This does not mean that buildings should not be bespoke in design, with appropriate provisions where needed, but that economies can be achieved via standardized elements.

The solutions presented in this publication and the others in the SSLD series have been developed based on extensive consultation under the auspices of the SSLD Forum. Set up by the former Department for Education and Skills (now Department for Children, Schools and Families), this forum represents key stakeholders in the building, design, research, contracting, and supply communities, as well as local authority construction clients.

Aim and scope of this guidance

This document provides performance specifications and example designs to enable the selection and design of internal stairways, including associated components and assemblies, for use in BSF secondary school renewal or refurbishments projects. This document does not include feature-designed stairways, which are likely to be a special piece of architectural design. However the considerations listed in this document are still likely to be relevant.

Specifically to:

- provide minimum standards of performance and quality expected by DCSF;
- provide design guidance for the formulation of technical specifications by project designers;
- standardise stairway dimensions and designs so that efficiencies and economies of scale can be generated within the supply chain; and
- enable caretakers and facilities managers to maintain, repair and replace components correctly.

This publication is structured as follows:

Section 2: Key performance requirements.

Section 3: Stairway planning and some design examples.

Section 4: References.

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Key performance requirements

The following key performance requirements set out specification standards and design considerations that the DCSF would expect to see adopted in BSF schools wherever it is reasonable and appropriate. Section 3 shows some design examples that address these requirements.

Accessibility

General

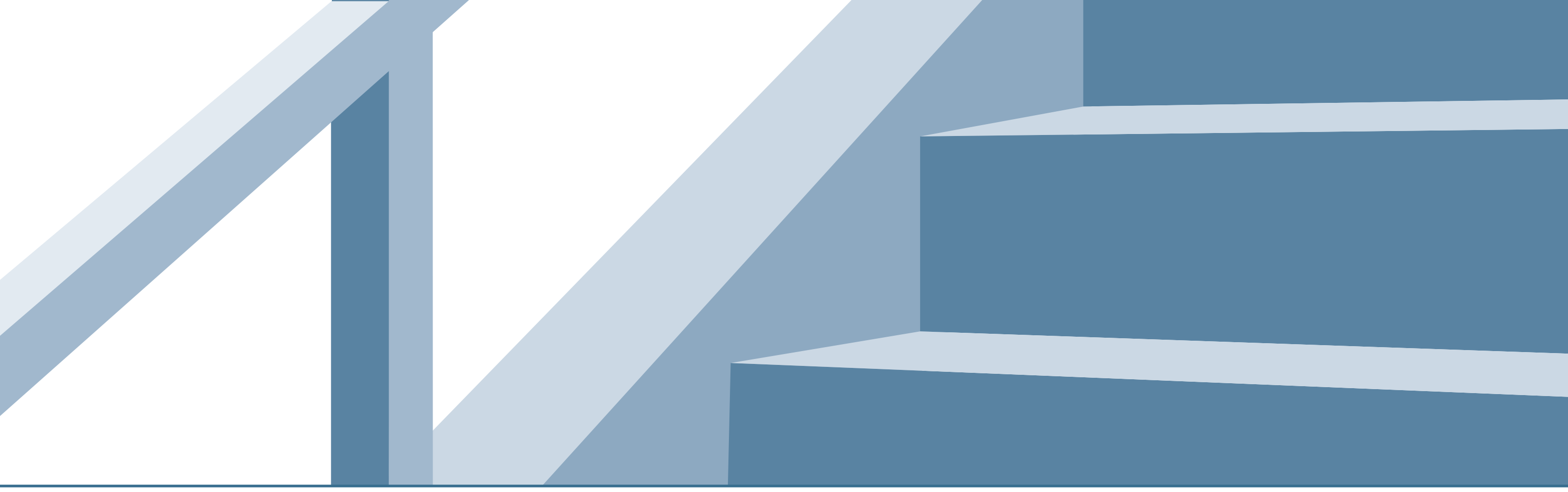
Good accessibility means buildings that are easy to understand and navigate. Designers should ensure that stair locations are convenient, safe and form part of a coherent movement and way-finding strategy.

People who cannot use a stair at all because of their disability – for example wheelchair users – are a very small proportion of the total range of people with disabilities. Designers must allow for the needs of a very wide range of disabilities, in particular those with:

- physical difficulty in movement or over-exertion (asthma or other breathing difficulties);
- short stature;
- visual impairment;
- intimidation or concern over vertical movement and complex spaces.

Good accessible stair design gives the following benefits:

- shorter journey times, and the ability to travel around the school with friends – improving inclusion;

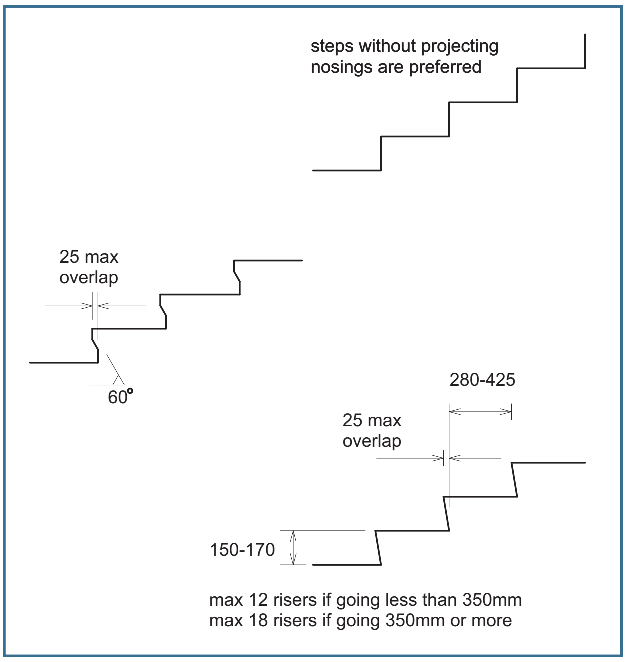


- more physical exercise throughout the day – as recommended by Occupational Therapists;
- generally, better design quality for all building users, able-bodied and physically-impaired alike.

Designers must therefore pay particular attention to the following areas:

- **A good way-finding and location strategy for circulation around the school.** This will assist those who have trouble with unfamiliar spaces and are intimidated by complex spaces. Consider providing good visual connections with other circulation routes and using different distinguishing colours for different stairways.
- **Design of stairs and landings.** The Building Regulations Approved Document Part M (ADM)[1] gives prescriptive design guidelines for design of stairs. ADM states a maximum of 12 steps between landings. This is necessary to provide a space to pause and rest, enabling physical recovery for those who have trouble moving. Stairways are preferred that have straight stairs without tapered treads, which make falls and accidents more likely. Because of this, spiral stairways are not recommended; they are also very difficult for guide dogs to navigate.
- **Step design.** Those who wear callipers or who have stiffness in knee or hip joints are at risk of tripping or catching their feet on nosings. For ease of movement, designers should provide simple step profiles that will not catch toes on nosings – ADM recommends square section steps (sketch below). Excessive rounding of nosings is not recommended.

  Open risers are not acceptable as visually impaired people find it difficult to locate the tread and may trip.



1 http://www.planningportal.gov.uk/england/professionals/en/4000000000988.html

BS8300 recommends treads of 300mm and risers of between 150 – 170mm and to address the needs of users with accessibility needs. To help 'future-proof' school buildings to support increasing inclusion and community use, including by the ambulant disabled, DCSF will expect school stairways in new school buildings to have a 300mm tread and 150mm riser as the standard dimensions for steps. It is recognised however that this may not always be possible where stairs occur, for example, between new and existing buildings of different heights.

- **Suitable handrails.** These are important to enable tactile guidance, physical support and reassurance. The DCSF will expect that a secondary handrail is included at a lower level where it is safe to do so. This would reassure and support not just younger students but people of short stature. The handrail should level out at each landing. This will give a clue to visually impaired people that the floor is about to become level. Handrail design is comprehensively covered in ADM.
- **Visibility.** People with impaired sight risk tripping or losing their balance if there is no warning of steps. The risk is most hazardous at the head of a stair when someone is descending. Stairs should have contrasting nosings and treads, and risers should be clearly distinguishable from each other[2]. Handrails should also have a clear visual contrast with their background without being highly reflective.

Low lighting levels and glare can disorientate those with a visual impairment; consider manipulating window and lighting design to provide a good even level of light with no harsh shadows or dark/light corners. The shadow of a window mullion on a bright sunny day may conceal a step or suggest an additional step.

Legislation, regulations and design standards relating to accessibility:

- **The Disability Discrimination Act (DDA)** provides protection to disabled people and defines disability as anyone with a physical, sensory, or cognitive impairment. It also includes those with mental health issues that have a substantial and long-term adverse effect on their ability to carry out day-to-day activities. In addition, Statutory Authorities have a duty to progressively improve access and inclusion and now to provide disability equality schemes outlining their intentions. The recent 2005 amendments to the DDA require that those providing education not only meet the DDA but ensure that they promote equality in all their functions and the Special Educational Needs Act (SENDA) apply to school premises.
- **Special Educational Needs & Disability Act (SENDA)** requires that disabled children will normally have their needs met within a mainstream school and that they should be offered full access to a broad, balanced and relevant curriculum throughout their school life. In addition pupils' access is required not only to the curriculum but all aspects of school life, including social activities, both in school time and also out of hours. An important aspect is travel distances and

2 For information on visual contrast see Colour, Contrast & perception: Design Guidance for Internal Built Environments, K Bright, G Cook & J Harris, University of Reading 1997.

perhaps more importantly time. A pupil needs to be able to quickly, in an equal manner access education and services. Positions, design, security and environmental conditions of stairs can have a huge impact on a large number of disabled pupils. Not just those with mobility impairments, many of whom will use the stairs, but those with medical conditions such as asthma, people of short stature, visually impaired people and those who might be intimidated by complex buildings.

- **Approved Document Part B (Fire Safety) of the Building Regulations** gives design guidelines for refuges in schools[3]
- **Design Guidance** Building Bulletin 77[4]: *Design Guidance for Pupils with Special Educational Needs and Disabilities in Schools,* which gives detailed advice on accessibility design is also available from:
  - The Centre for Accessible Environments[5];
  - BS 8300 Design of buildings and their approaches to meet the needs of disabled people – Code of Practice.

Health and Safety

General

In addition to the requirements of the statutory Building Regulations, designers will need to consider and identify any other hazards that may be caused by the stair design (slipping, sharp edges, maintenance etc). The stair designer will also need to consider the requirements of the Fire Safety and Security Strategies.

Balustrades & handrails

Handrails are necessary to provide support and guidance to users of stairs or balconies and therefore need to be firmly supported. Balustrades provide pedestrian safety guarding to prevent falls from height[6]. The two purposes are generally combined into one component assembly.

Stairs need continuous handrails to both sides of stairs, including any landings. The detailed diagrams in Section 3 assume flank walls are solid and the outside handrail can be bracket supported off these walls.

3 See www.planningportal.gov.uk/england/professionals/en/1115314683691.html. See also BS 5588: Part 8.

4 Building Bulletin 102, provisionally entitled Designing Schools for Children with Special Educational Needs and Disabilities, due for publication in early 2008, will replace Building Bulletins 77, 91,and 94

5 www.cae.org.uk

6 Structural Loadings should be calculated by a Structural Engineer.

A central well between stairs (200mm suggested width) allows for a balustrade that can be either fixed to the side of the stair or onto the top. A side-fixed balustrade will allow a greater unobstructed width in use and fixings will provide less of a dirt trap; however it will be harder to install as the space available is less. Proprietary balustrade/handrail systems may be easier to install in such a situation. Alternatively a solid balustrade could be formed, making a solid wall with applied handrail only between stair flights (see below).

Building Regulations require that the profiles of handrails are either circular with a diameter of between 40 and 45mm, or oval preferably with a width of 50mm. Handrails must not protrude more than 100mm into the surface width of the ramped or stepped access where this would impinge on the stair width requirement of Part B1. There must be a clearance of between 60mm and 75mm between the handrail and any adjacent wall surface.

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▲ **Above** timber clad wall between flights instead of a balustrade, with matching finish to treads

Building Regulations require that any handrail is 900 -1000mm above the nosing line of stairs and 1100mm at landings. Pedestrian Guarding in schools must be 1100mm above finished floor level. In schools with pupils aged 12 or under DCSF prefer an additional lower handrail, say at 600mm for infants and people of small stature.

Balustrades must be designed to prevent students from climbing up towards the handrail. Avoid horizontal rails in balustrade design; any opening should prevent a 100mm sphere to pass through. Detailed guidance is available in CP BS 6180:1999 *Barriers In And About Buildings*.

Finishes for handrails/balustrades must be chosen to contrast with the background that they will be viewed against and must not be highly reflective.

Open stair wells in unsupervised areas should be carefully assessed. Some schools, concerned about the safety of students and lack of effective passive supervision have installed balustrades higher than 1100mm high at landings where there are voids below of over two storeys. If they are required, or fitted later as an afterthought they may be detrimental to the overall appearance of the stair.

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▲ **Above** additional safety balustrade to stairwell in galvanized metal with mesh infill

Coated finishes (paint, varnish or polyester powder coating) will necessitate a regular re-coating maintenance regime. Coated finishes are also easily damaged, accidentally or by vandalism.

Self-finished materials are preferred as they attract minimum maintenance effort over the life of the building: satin finished stainless steel or aluminium, zinc or aluminium sprayed steel. However designers must ensure that these finishes are chosen to give adequate tonal contrast and not create glare by bright light reflection.

Floor finishes

The finished floor surface of the treads needs to offer a durable surface. A slip resistant surface should not be necessary unless stairs would normally become wet. This may occur either through spillages or the flow of heavy foot traffic from playground to classroom during bad weather[7].

Stair nosings must be made apparent with a permanent contrasting zone of 55mm on both tread and riser[8]. Specifying an anti-slip nosing product should be considered to reduce slipping on the stair.

For information on floor finishes please see the SSLD Document Floor Finishes in Schools, specific research and detailed guidance for stairs can be found in the CIRIA publication Safer Surfaces to Walk On[9].

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[redacted]

▲ **Above** carborundrum strips set into pre-cast terrazzo treads on pre-cast concrete stair and an in-situ concrete central wall between flights instead of a balustrade

7 Please see SSLD Floor Finishes in Schools.

8 Approved Document Part M: Definition of Contrast 0.29. Also Colour, contrast & perception – design guidance for internal built environments. Keith Bright, Geoff Cook and John Harris. University of Reading.

9 J Carpenter, D Lazarus & C Perkins, CIRIA 2006.

Lighting

Make maximum use of natural light in stairwells. As fire escape routes need to provide direct access to a place of safety, stairwells are likely to have at least one external wall. Balance provision of windows with the need for safe cleaning and the avoidance of excessive solar gain. Designers should ensure mullions do not form a shadow across stairs and landings in order to avoid confusing visually impaired people.

Artificial lighting should be of a sufficient quality that it adequately illuminates the stair, landings and doors with evenness of light and without glare[10]. However access to the light fittings for maintenance and cleaning should not create a dangerous situation for a person carrying out the work. Lighting suspended from the ceiling over stairs and half landings is difficult to access and requires specialist access equipment. Wall-mounted lighting (out of reach) situated over the landings and half-landings allows easier and safer access for maintenance. Switching of lights should be such that when natural light levels fall during the day only the luminaries away from windows need be switched on[10].

Whatever lighting solution is chosen it should be the result of a rigorous risk assessment and collaboration between the architect and services engineer.

Maintenance

Floor cleaning is significant in causing slip and trip accidents, both to cleaning staff and others. Risk assessment and collaboration between the Facilities Maintenance team, school user client and design team should be carried out to ensure adequate provision and placement of cleaning facilities to best accommodate a safe and efficient cleaning regime.

Protection below stairs

Projecting stairs without enclosed space below will cause a hazard for the visually impaired, and where the soffit is 2.1m or less above floor level it should be enclosed by low level guarding including cane detection or a permanent barrier. Permanent enclosure is often the simplest solution.

Fire refuges

Refuges are relatively safe waiting areas for short periods of time (not areas where disabled people are left alone indefinitely) until rescued by the fire service or the fire is extinguished.

The Building Regulations Approved Document B: Fire Safety (ADB) advises one refuge per fire-protected stair on each storey. These can be located within the stair enclosure or in a protected space directly accessing the stair, for example, a lobby or compartment. The space should be a minimum of 1400x900mm and not reduce the width of the escape route. Mandatory refuge signs are required[11].

Refuges will form part of a fire safety risk assessment and any resulting management plan required by the Regulatory Reform (Fire Safety) Order 2005. Designers should confirm the brief with the client as the number of wheelchair users may vary between projects; the fire safety strategy must accommodate these numbers. As a result, there may need to be refuge space for several people.

An Emergency Voice Communication system must be provided at each refuge point. This enables occupants of each refuge to alert others that they are in need of assistance and to receive reassurance that this will be forthcoming.

10 Please see SSLD Lighting Systems in Schools.

11 See Section 3 for full design requirements of refuges.

Materials

Material choice

The design of the stairway will influence the construction solution, which in turn will inform the decision for the choice of stair material – whether steel or pre-cast concrete[12]. The pros and cons of each are set out in the table below.

The choice should be driven by practical considerations such as compatibility with the building's structural solution, acoustic performance, environmental impact, whole life costs, and potential use during the construction period and maintenance.

It is usual for contractors to use stairways to access all floors of the building during the construction process and this may affect the choice of material.

Proprietary temporary stairways offer alternative access to all floor levels and are supplied and erected by scaffolding contractors. Using temporary stairways presents the opportunity to explore an alternative method of procurement, supply and delivery of the stairways, balustrade and associated finishes.

		Steel	Pre-cast concrete
1	**Sustainability**	Average	Poor
2	**Durability**	Good	Good
3	**Self finish**	Average	Good
4	**Suitability for applied finishes**	Poor	Good
5	**Adaptability**	Average	Poor
6	**Installation**	Average	Good
7	**Maintenance**	Average	Good
8	**Repairability**	Average	Poor
9	**Acoustics**	Poor	Good
10	**Thermal mass**	Average	Good
11	**Light reflectance**	Average	Average
12	**Use in construction**	Average	Good
13	**Slip resistance (untreated)**	Poor	Poor

12 Timber is generally not robust enough for schools stairs, although it may have some application in feature stairs.

Finishes

Stairways in schools can be difficult to monitor in relation to pupil behaviour or vandalism, therefore robustness of all finishes, fixtures and fittings is important. Special consideration of finishes must be made with regard to contrasting treads and risers.

The choice of tread finishes are either to use applied finishes or a self finished stair. Applied finishes could include thin material finishes such as carpet, lino and vinyl, or liquid applied finishes such as resin floor systems; and thicker finishes such as ceramic tiles or timber[13].

There are obvious pros and cons to both approaches; for example guaranteeing a high enough quality of finish and uniformity of colour in self-finish pre-cast concrete stairs, also protecting self-finished concrete during the construction process. An applied finish to pre-cast concrete stairs allows construction tolerances, imperfections and site damage to be hidden (see photos below and opposite). However some applied finishes are susceptible to wear and tear and may require other specialist fittings around balustrade fixings and at stair sides.

Construction materials **benefits** and **drawbacks**:

	Benefits	**Drawbacks**
Steel	• semi-adaptable on site to fit stairwell tolerances; • integrated balustrade achievable; • whole stair and guarding may be manufactured off-site by one supplier.	• labour intensive; • early procurement may be required.
Pre-cast Concrete	• longer spans; • fast installation.	• un-adaptable; • early procurement required.

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▲ **Above** steel staircase and balustrade with carpet finish

▲ **Above** a mastic joint and mdf skirting fills the construction joint between a self-finish pre-cast concrete stair and the wall

13 Please see also SSLD *Floor Finishes in Schools*.

Walls are likely to have shoulder bags rubbed along them on a daily basis and will require regular cleaning. Textured surfaces such as fair-faced or paint-grade block work hide marks more effectively than flush painted surfaces and make it difficult to write or draw on.

If no applied wall/ceiling finish (paint and plaster/suspended ceiling) is used, services will be visible, so special consideration as to what this will look like will be necessary and must be co-ordinated with the services engineer.

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▲ **Above** steel staircase with studded rubber sheet finish, timber handrails and metal balustrade

Assembly & construction

The benefits of in-situ assembly of pre-fabricated elements will vary as between each type of stairway construction and will affect the sequencing of works. Stairway elements will either be installed as the frame of the building is erected or will require the completion of a load-bearing shaft before installation. Where the stairway is required to fit within a confined space, stairs will either need to be procured early for mechanical installation or be manoeuvrable enough to be handled on site.

Steel stairways offer benefits of flexibility and adaptability which may suit installation into tight stair shafts, or where the construction sequence prohibits large components being installed. Where sufficient lead-in has been allowed to design and construct the stairs, larger span concrete elements can be installed quickly with reduced costs.

Sustainability

The Building Research Establishment Environmental Assessment Method for Schools[14] is the standard tool for assessing the environmental impact of a school. Schools are required to meet the BREEAM standard Very Good and must specify sustainable products – the environmental performance of building materials is published in the Building Research Establishment's Green Guide to Specification[15].

The Green Guide to Specification categorises materials and combinations of materials used for different purposes in a building. Each is given a rating from A+ to E depending upon its sustainability performance. An A or A+ rating should generally be specified where possible. The sustainability of materials used to construct the stairs and balustrades should be considered at the earliest stage of a project and the material selection must be considered in the context of the entire building design and life cycle. Where materials are considered in isolation issues such as the application of finishes or the benefits of mass production will not necessarily be accounted for – selection of stairway materials should therefore be balanced against a full range of issues.

Sustainability considerations informing the material selection process:

	Sustainability considerations
Steel	• high content of recycled material; • recyclable at the end of its useful life, or reusable; • highly durable material, exceeds building design life; • reasonable levels of off-site prefabrication achievable; • material can be finished with robust coatings such as galvanizing or flame sprayed zinc which require virtually no maintenance or periodic redecoration.
Concrete	• high thermal mass; • can be recycled as crushed hardcore; • material can incorporate recycled aggregates, spoil from aggregate mining, pulverised fuel ash and power station slag[16]; • concrete is very durable; • can be self-finishing with correct specification; • where concrete stairs can be standardised to allow re-use of moulds this will provide opportunity to minimise material use, eliminate waste and improve finish quality.

14 BREEAM for Schools. http://www.breeam.org/schools

15 The Green Guide to Specification 3rd Edition, Jane Anderson/ David Shiers with Mike Sinclair. BRE 2002 http://www.bre.co.uk/greenguide/page.jsp?id=499 was out of print when this guidance was prepared.

16 www.aggregain.org.uk

Maintenance

Durability

Internal stairways intended as permanent installations are required to perform satisfactorily, given reasonable use and expected standards of maintenance, for a period of 60 years.

Routine maintenance

Recommended cleaning and maintenance instructions for exposed surfaces of stairways shall be provided in the school's Health and Safety File. The maintenance regime for the stairway will include daily cleaning, regular deep cleaning, potential repair and periodic redecoration. The detailed design of the components that make up the stairway should consider the durability of the materials selected and how they interface.

Design for maintenance

Design that eliminates complex junctions between elements will allow a simplified cleaning and repair regime to be implemented. This will require sufficient time for detailed design and the integration between trades to co-ordinate fixings and accommodate site tolerances. The creation of a repeatable standard component should seek to maximise efficiency by the use of controlled factory production methods.

Avoidance of surface fixings will allow daily cleaning to be more effective, but requires co-ordination between stair manufacturer, balustrade fabricators and surface finishes. Self finished materials will avoid the need for re-application of surface finishes, but must be durable enough to respond to a cleaning regime and maintain the aesthetic qualities of the original material.

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▲ **Above** highly durable self-finished materials: terrazzo tiles to treads, risers and skirting; glass balustrades; stainless steel handrails and balustrade supports

Maintenance considerations informing material selection

	Benefits	Drawbacks
Steel	• durable; • self finished (high quality integrated finishes).	• protruding fixings/welds; • manufacturing tolerances between components. • poor acoustic absorption.
Pre-cast Concrete	• durable; • mouldable details.	• difficult to repair; • potential surface discolouration.

Internal corners can be difficult to clean; consider designing components with filleted or chamfered corners to allow for easier access for maintenance. Likewise any gap between the stair and a wall can easily trap rubbish and dirt; consider designing a raised stringer that can be more easily sealed against an adjacent wall. Either of these design changes could potentially add cost to a stair, but will be worth the extra when considered as part of a full life cycle cost that includes cleaning and maintenance.

Standard dimensions

Standard dimensions for stairways will maximise the potential for repeatability and off-site manufacture. This can improve quality, and reduce costs, site time and risks associated with on-site fabrication. The SSLD Forum proposes standardising dimensions for:

- floor to floor heights;
- stairway treads and risers;
- stairway widths

Floor to floor heights

In line with much of current design practice, it is proposed that the standard floor to floor height for secondary schools should be established at 3.600m. This dimension is considered by the SSLD Forum to provide the optimal balance as between the sometimes opposing requirements of ventilation, daylighting, acoustics, structure, space planning and budget[17]. The stair design examples in Section 3 are based upon this dimension.

Stair treads and risers

In relation to users with accessibility needs, the DCSF preference is for 300mm treads and 150mm risers (equal to two brick courses or 2/3 block course) without protruding nosings to meet the best practice guidance of BS8300[18].

17 See SSLD Learning Spaces

18 Design of buildings and their approaches to meet the needs of disabled people

Stairway widths

Factors for designers to consider:

- the width of circulation (corridors, stairways and final exit doors) must be designed to ensure an appropriate level of life safety in the case of fire. Guidance on means of escape design is provided within documents such as Approved Document B and Building Bulletin 100. The fire safety strategy for a building will determine the minimum width adequate for safe evacuation of building users;
- day-to-day movement flows required of building users;

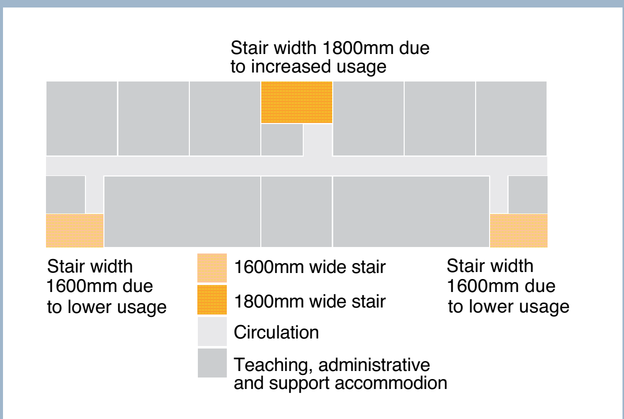
In relation to secondary schools DCSF proposes three standard widths:

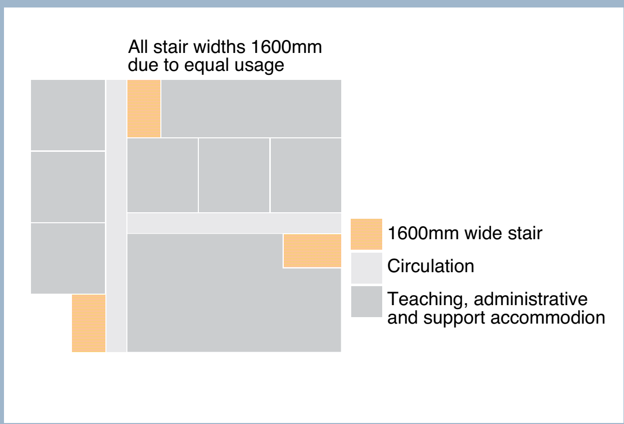
- 1200mm. The minimum width permitted by ADM. This is only advised for little-used stairs;
- 1600mm. This enables two adults to pass each other with ease and permits 3 people to safely carry down a wheelchair user when required;
- 1800mm. This is the widest stair option, with increased widths generally requiring an additional centre handrail.

The width of stairs is measured as the clear width between walls or balustrades and ignoring projecting handrails, provided that these comply with the requirements of the Building Regulations (see Page 10).

These standard widths will satisfy the majority of internal stairway requirements whilst providing good opportunities for standardisation and repeatability. The examples in Section 3 are based upon the 1600mm dimension, but include a key for adjusting the dimensions to other widths.

When deciding upon stair widths for a school circulation design, in addition to considerations for fire safety, consideration should be given to the predicted usage of the stair. The following diagrams illustrate this principle.





Design and construction

General stability and structural resistance

An internal stairway should have the capability to withstand all incidental static, dynamic and impact forces under normal conditions of use. A stairway should be adequately secure and without undue vibration under normal conditions of use.

Fabrication method

The sequencing of the stair installation within the construction programme to allow early use by the contractor may be beneficial to the overall project, but will potentially influence the design and/or selection of materials.

Speed of erection, durability and safety in the temporary use condition will need to be considered against the provision of separate access stairways.

The stairway could be constructed on site out of a range of components with each individual element being supplied and installed by a separate fabricator throughout the construction programme. Alternatively the entire stairway enclosure could be delivered pre-fabricated for installation at a given time in the programme. Typical benefits and drawbacks of each approach are highlighted below, although proposals developed with component fabricators could design out the potential drawbacks.

Early involvement of a building contractor to determine the construction sequence will identify which method of construction suits the specific project. Cost analysis should compare savings on preliminary costs against the practicalities of using stairs during the construction process and the potential risks of damage.

	Benefits	Drawbacks
On-site assembly of pre-fabricated components	• early installation of stairs for use during construction; • cost savings on temporary access stairs; • minimal protection requirement; • flexible design; • ease of assembly through manageable component sizes.	• temporary handrails and treads (steel stairways) required; • congestion of finishing/second fix trades at end of programme; • co-ordination and tolerance risks between trades; • structural redundancy of material/components; • interface detail to resolve.
Full pre-fabrication off-site	• high quality pre-finishing achievable; • structural economy through holistic design approach; • minimal protection requirements; • single point of responsibility; • cost certainty; • lower cost for volume production (through standardisation).	• limited use during construction; • cost/space implications of additional temporary access stairs; • early procurement required; • higher cost if limited level of production; • limited scope for late change.

On-site construction using pre-fabricated components has traditionally been adopted on projects over full pre-fabrication or in-situ construction. Allowing sufficient time for design development to occur prior to start on site will enable the drawbacks of an off-site construction method to be overcome.

High quality components fabricated off-site which have considered the integration of all elements, will allow flexibility to be maintained whilst delivering a fully integrated quality product.

Free-standing stairs placed in slightly larger stairwells could readily be developed into a product that allows for full pre-fabrication off-site, and suitable for more than one school.

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▲ **Above** free standing stair in circulation area

PHOTO REDACTED DUE TO THIRD PARTY RIGHTS OR OTHER LEGAL ISSUES

▲ **Above** free standing stair in learning area

PHOTO REDACTED DUE TO THIRD PARTY RIGHTS OR OTHER LEGAL ISSUES

▲ **Above** free standing steel stair with vinyl sheet floor finish to treads and landings in stairwell

Further design issues

A number of related issues must be considered by buildings designers and clients in order to coordinate good stairway design.

Provision for building services

Services within stairway enclosures should be minimised. However, where services are run within or through stairways, their installation should not lower the performance of the stairway below the level required for sound insulation, fire resistance, and any other relevant requirements.

Further Requirements for Building Services:

- IEE Regulations & Building Regulations;
- provision of fixings and chases for services in masonry partitions shall comply with BS 5628-3. Non load bearing masonry walls shall not have back to back chases within 300mm of each other. The maximum depth of chases shall be advised by the Structural Engineer;
- access panels shall be provided for maintainable mechanical and electrical items.

Ventilation

Stairways, in the case of escape, must be kept clear of smoke so that safe egress can be achieved. If the design is likely to allow smoke into a stair shaft it is essential that an effective method of smoke removal be an integral part of the design.

Smoke removal can be achieved by natural means such as opening windows or stack ventilation at the head of the stair enclosure. Mechanical ventilation can be used and may be necessary where the ventilation strategy and design of the school necessitates such a solution.

Seek advice from a fire or building services engineer and building control at an early stage of the design process.

Heating

Depending upon the use and location of the stair heat emitters may be required.

Any wall mounted heat emitter should be located so as not to obstruct or impinge on the use of the stair, the landings, the refuge or the designated escape route[19]. Additionally wall or floor mounted heat sources present an opportunity for pupils to climb and to fall, potentially down or over the stair or balustrade. Placement of the heat source should be carefully considered. In both instances co-ordination with the design of the services engineer will be needed.

The robustness of any wall/floor mounted heat emitter, any associated control devices, and its fixings should be assessed for the potential for vandalism as the stair core can be difficult to monitor. The volume and movement of boisterous traffic can result in the reduction of lifespan of such fittings; additionally, the height of these fixtures lend them to being used as wall mounted seating and as such the maintenance and decoration of the heat emitter should also be reviewed. Alternative heat sources such as underfloor heating or radiant panels could be considered.

Acoustics

Stairways are potential sources of disruptive noise within the school environment and particular attention should be paid to the acoustic properties of the stairway in the design and construction phases.

Designers must consider:

- noise breakout from the stair. Lightweight forms of construction may introduce unwanted noise into adjacent spaces;
- noise absorbency within the stair. A quantity of sound absorbing material will can be introduced to reduce the level of sound within the space.

Building Bulletin 93[20]: *Acoustics in Schools* gives guidance in both areas; in addition it is important that an acoustic engineer is consulted at an early stage of school design.

19 Approved Document Part M 3.14 a

20 Building Bulletin 93: Acoustics in Schools. Available at: www.teachernet.gov.uk/schoolbuildings

Other elements

Outside the scope of this report are a number of design features that will occur in stairwells which must be carefully coordinated:

- light fittings – will they be best located on walls or on ceilings, will conduit be concealed by plaster?
- passive infrared security sensors, fire call points, fire alarm bells/beacons, light switches – how will these be located to avoid tampering and vandalism?
- directional signage – will it be necessary in the design and how will it be incorporated?
- windows – fixed or openable lights, what robustness/safety requirements are necessary? Does it act as a balustrade?
- ironmongery – should be durable and robust.
- doors – may be on hold-open devices which release in the event of a fire to increase flow rates and reduce incidental damage to the doors in use.

Cost comment

The stairs element (including associated handrails and balustrades) usually represents between 1% and 2% of the total building cost of a large secondary school.

The school's teaching and operational model will have a crucial effect on the plan form of the building and the resulting efficiency of core arrangements and stairway locations. Other factors, such as the number of storeys, site gradients requiring split levels, and external circulation routes can have a considerable impact on an otherwise minor cost element. Current experience indicates that the cost of stairways per m^2 of gross internal floor area can vary considerably, from between £9/m^2 for the most efficient large schemes, to £65/m^2 for more involved or elongated proposals.

Key drivers affecting the overall costs of the stairs element include:

- size of building;
- number of storeys;
- efficiency of plan shape and total number of cores – buildings with separate wings or split-level sites are likely to be more costly in terms of vertical access;
- fire strategy considerations and means of escape distances;
- type of stairway and overall geometry – escape stairway or feature stairway;
- overall stair height, width and going;
- number of flights and intermediate landings required to achieve the rise;
- type of construction – steel or concrete;
- method of support – e.g., shelf angles, cantilever, hanging or propped;
- level of specification for balustrades and handrails;
- type of floor finishes;
- crush loadings applicable to handrails and balustrades.

The overall cost impact of adopting the more generous 150mm x 300mm step dimensions to meet DDA/ambulant disabled requirements is estimated to be £35-40,000 per secondary school, representing the larger footprint of the stairs. There should however be scope for efficiencies from the standardised approach and from opportunities for off-site fabrication which will help to offset the additional costs.

Stairway planning and design examples

This section outlines the general planning considerations relating to the positioning and design of stairs in secondary schools. It then provides examples of four stair design examples – Types A to D – that should meet the performance requirements set out in this guidance.

These examples do not preclude the designer from using other arrangements to achieve particular layout configurations. However, the alternative proposed stair arrangement or type should conform to the key performance requirements.

The examples shown simply offer guidelines – it is for those involved to use their own skill and expertise in deciding what will be a reasonable and appropriate final design solution in their particular situation.

Stairway planning

Recent school building designs have taken a wide variety of forms, from long strip arrangements to denser blocks arranged around courtyards. At a finer scale however these designs tend to be composed of cellular teaching spaces (of between 60-100m^2) arranged either side of circulation routes.

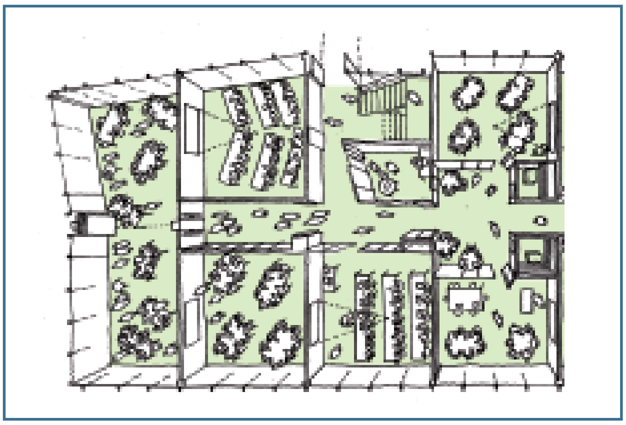
Locations for the majority of stairs within a school are driven by the demands of fire safety; most commonly in relation to travel distances. Maximum travel distances are specified within guidance such as Approved Document B and Building Bulletin 100. These guidance documents provide an informed way of satisfying the Building Regulations. They also state that alternative solutions may be proposed if it can be demonstrated that they achieve the appropriate level of safety; alternative solutions may include flexibility on stair locations if an appropriate strategy is put in place. Fire Safety Engineering is a recognised approach for developing alternative fire safety solutions.

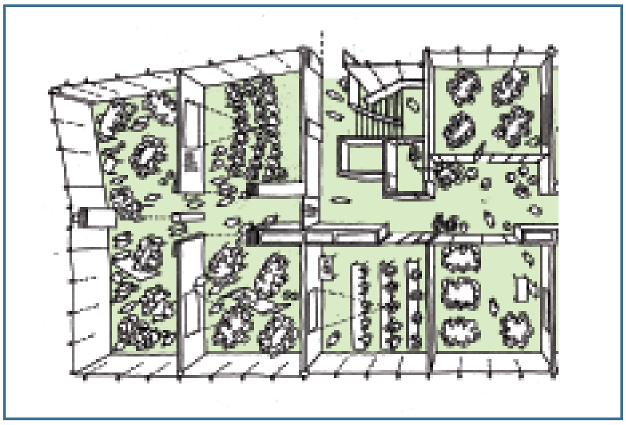
Whether or not an alternative solution is adopted, economies and better designs can be achieved where the design for fire safety integrates well with the design for normal movement; accounting for additional considerations such as bullying in enclosed spaces. Where possible, expensive fire escape stairs (especially enclosed cores) should not be redundant for normal usage.

The following considerations should also be taken into account, particularly suiting the needs of the personalized learning agenda:

- it is advised that efficient and balanced use of stairs and other circulation provisions is one of the considerations during the early stages of a school design (e.g. concept stage). Different school geometries will inherently achieve different levels of performance for their circulation provisions.
- locating stairways away from the very ends of corridors increases the adaptability of the spaces at the ends of corridors; two or more cellular classroom spaces can be converted into a larger open plan teaching space (see sketches below);
- consideration is also needed of the effect of the staircase locations on potential for future expansion;
- fire escape stairs should have a level exit directly to the outside of the building;
- stairways well distributed will ensure shorter travel times between lessons, maximising time for learning and consequently promoting a calmer atmosphere;
- locating and sizing stairs and corridors to achieve balanced and appropriate use of circulation provisions within the school will reduce congestion and maximise comfortable conditions. Aim to provide the greatest widths where pupil flows will be highest. Providing single stairs and/or corridors in locations where it is likely that a majority of pupils will circulate during such as class changeovers is likely to cause unnecessary congestion and should generally be avoided without due consideration;
- providing only one or two stairs for circulation may be insufficient for most secondary schools. This should be avoided without due consideration for possible congestion.
- wider stairs enable quicker movement and reduce social friction between students – widths greater than 1550 allow carry down evacuation for wheelchair users;

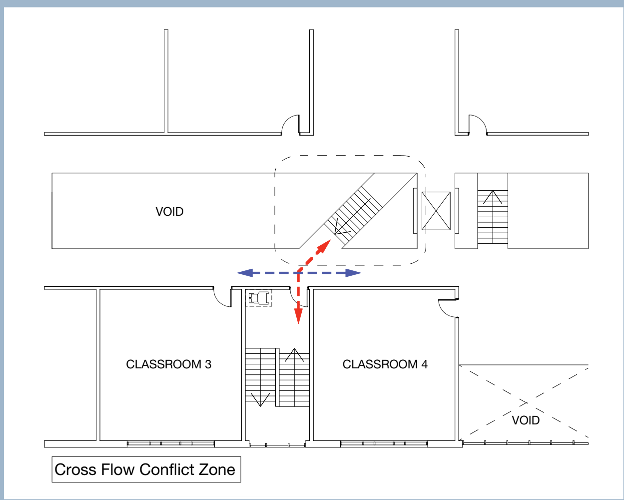
- stairs are often the location for bad behaviour and bullying. Promote maximum views in from circulation routes and out to surrounding spaces to increase passive surveillance and the feeling of security. Consider placing doors on electro-magnetic hold-open devices linked to the fire alarm (this also minimises damage in use) and large glazed screens to circulation routes within the school;
- consider grouping stairs, toilets and lockers together and locating staff workspaces nearby to maximise overlooking and student security from bullying. Successful past designs have located staff work rooms adjacent to stairways with large glazed screens between the spaces so that teachers will overlook the stairway (note that accessible WCs are better located close to lifts and stairs – see SSLD Toilets in Schools).
- building users incorporate stairways in their mental map of way-finding around the school. If they are easy to find and clearly differentiated then new users and those with anxiety over familiar spaces (for example in autistic spectrum disorder) will benefit. Colour coding can assist with locating of specific areas and assist in evacuation.
- external stairways are likely to be more cost effective than internal ones; however they are not a preferred solution. They can be dangerous in wet weather, provide a risk to building security, and will increase maintenance needs as they will admit dirt and water, and energy costs as they will allow heat to escape. They are very unlikely to provide a suitable accessible stair for disabled building users.

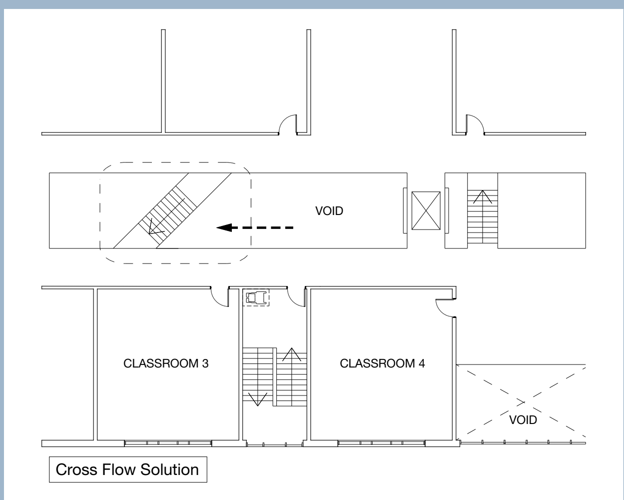




▲ **Above** ground and first floor layouts of classrooms in a teaching wing, showing how the cellular spaces can be used to create a large flexible learning space suitable for the proposed personalised learning agenda. Note the staircase is located away from the end of the wing to enable this and can be supervised by a staff base.

- space below a staircase should be guarded or enclosed for safety reasons. If this space is to be used as a store then consider carefully any fire hazard and vandalism likely because of poor supervision.
- stairs should be located to avoid significant direct cross flows which are uncomfortable and may be a cause of disruptive behavior. One example of design leading to undesirable cross flows is Illustrated in the following diagram, together with one possible solution.





▲ **Above** designing out circulation cross flows

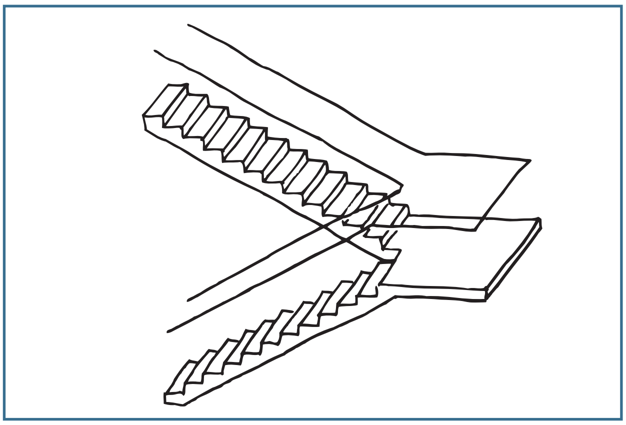
The following four stairway examples are all based on a 1600mm wide stair with the preferred 150mm rise and 300mm tread.

Type A Stairway: Dog-leg with equal flights

A simple and very standard stair configuration.

At ground floor any space with headroom less than 2.1 should be enclosed.

A type A stair could be positioned near the end of a double-loaded corridor like this. An adjacent staff room with glazed screens on three sides would overlook students in both the corridor and the stairs to deter bullying. External glazing to the stair will gives views out, daylighting, improve passive supervision, and aid wayfinding.



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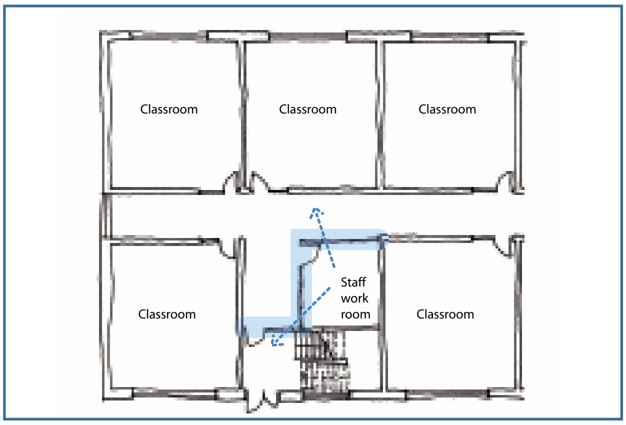
▲ **Above** Type A stair with glazing assists wayfinding

Because you are returned to the same point in plan on each floor this stair works better with single-sided circulation plans. The plans on the following page show how a ground floor plan might work including a final exit from the building.

The stair below would need a protected lobby with a final exit door just outside the access door.

A 1600mm wide type A stairway will take up around 26sqm.



Type A stairway: typical dimensions

This stairway type is based on a 1600mm wide stair with the DCSF's preferred 150mm rise and 300mm tread.

Minimum escape door widths are determined by the detailed fire strategy for an individual school.

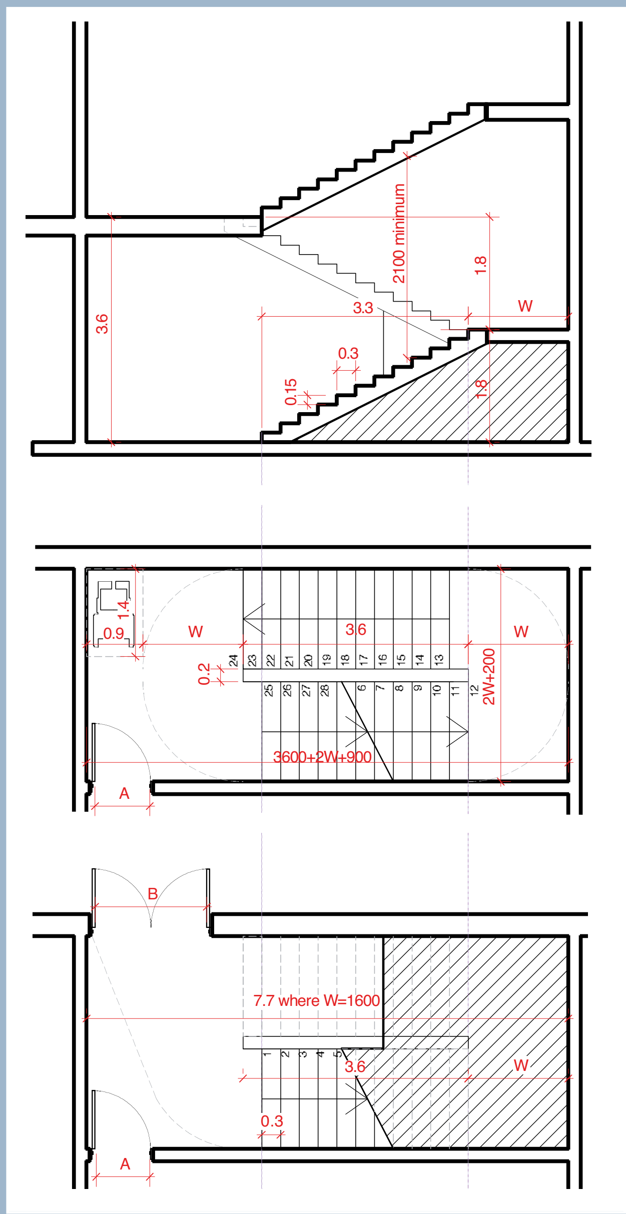
A indicates the storey exit requirement.

B indicates the escape stair final exit requirement.

Doors may be wider and single or double leaf as required by the brief. Depending upon the fire strategy for escape on ground floor, the final escape door from the stair may need to be equal in width to the aggregate of the stair width and the storey exit width. Doors must not swing into the zone of escape flow, defined by the dashed line.

W refers to the structural width of the stair (not including handrails) and can be adjusted to develop this for wider or narrower alternatives.

Any area below flights with a headroom of less than 2.1m should be enclosed and is here shown hatched.



Type B stairway: Dog leg with unequal flights

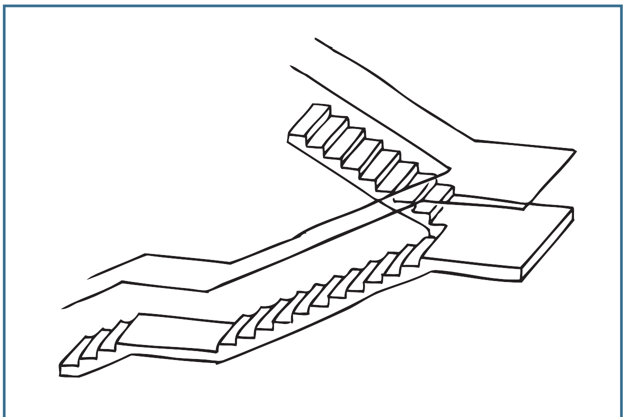
This development of a standard dog-leg stair has two unequal flights so that there is adequate headroom to pass below the half-landing safely.

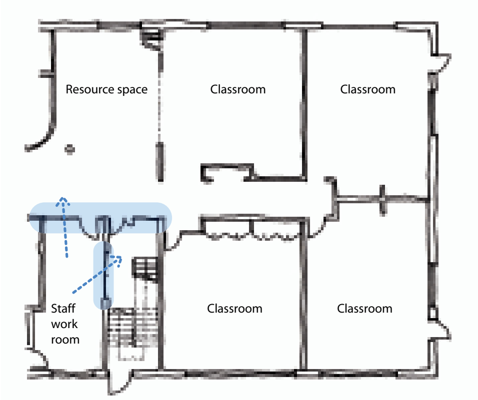
The first flight has 16 risers, but is broken by a single landing so that there are no more than 12 risers in one flight. This provides the necessary opportunity for ambulant disabled to pause and rest.

At ground floor any space with headroom less than 2.1m should be enclosed.

This stair enables a ground floor final exit on the opposite side of the stair enclosure from the one you enter it from. This stair type could be positioned near the end of a double-loaded corridor like this. An adjacent staff room with glazed screens on two sides would overlook students in both the corridor and the stairs to deter bullying.

The length of this stairway would mean that it would project internally as shown beyond the line of the classrooms (but aligning with built in cupboards), where used in conjunction with a 7.9m standard depth teaching space, so that the stair wall is on the building line (see SSLD Learning Spaces). Alternatively the stair could project externally as shown on the drawings on the following page.





A 1600mm wide type B stairway will take up around 32sqm.

Type B stairway: typical dimensions

This layout is based on a 1600mm wide stair with the DCSF's preferred 150mm rise and 300mm tread.

Minimum escape door widths are determined by the detailed fire strategy for an individual school.

A indicates the storey exit requirement.

B indicates the escape stair final exit requirement.

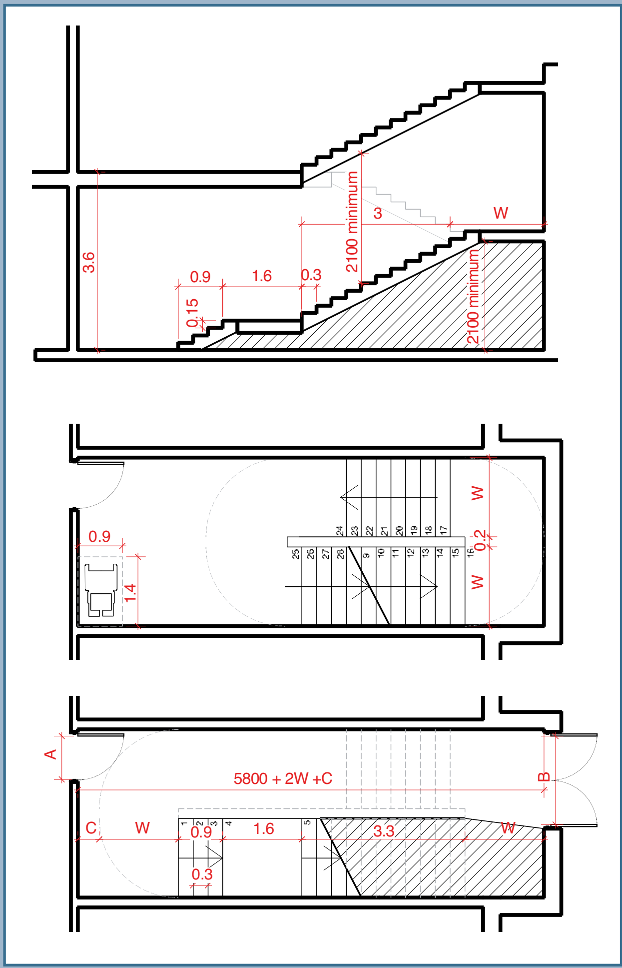
Doors may be wider and single or double leaf as required by the brief. Depending upon the fire strategy for escape on ground floor, the final escape door from the stair may need to be equal in width to the aggregate of the stair width and the storey exit width. Doors must not swing into the zone of escape flow, defined by the dashed line.

In this design the storey exit door width at ground floor will affect the overall length of the stair enclosure. C indicates the dimension generated by the interaction with the zone of escape flow.

The length of this stairway would mean that it would project as shown, beyond the line of the building, where used in conjunction with a 7.9m standard depth teaching space, so that the stair aligns with the line of the classrooms at the corridor (see SSLD Learning Spaces).

W refers to the structural width of the stair (not including handrails) and can be adjusted to develop this for wider or narrower alternatives.

Any area below flights with a headroom of less than 2.1m should be enclosed and is here shown hatched.



Type C stairway: Square open-well

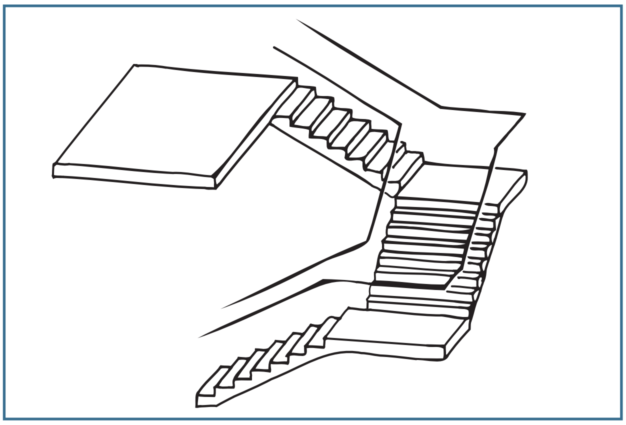
This stair has three equal flights and two intermediate landings around a central open square well.

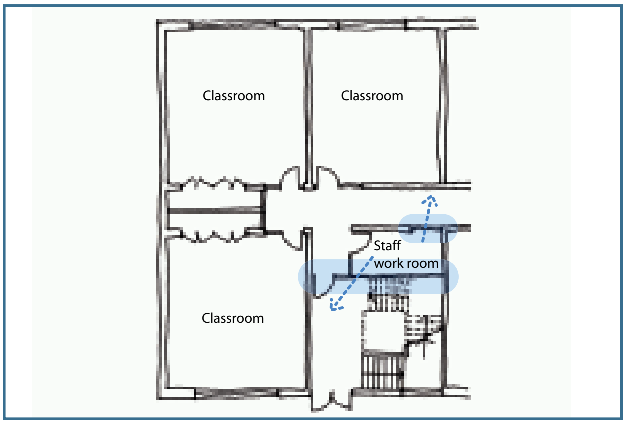
This layout has the largest floor area requirement of the four types, but the space in the central well is large enough to accommodate a lift. This could be constructed at construction stage, or in future stages of the building's life if the need for mobility across the school increases in time.

At ground floor any space with headroom less than 2.1 should be enclosed.

This stair can sit between an external wall and a corridor, the space left over could be used as a staff work room, group seminar space or a store room.

A 1600mm wide type C stair will take up around 36sqm.





Type C stairway: typical dimensions

This layout is based on a 1600mm wide stair with the DCSF's preferred 150mm rise and 300mm tread.

Minimum escape door widths are determined by the detailed fire strategy for an individual school.

A indicates the storey exit requirement.

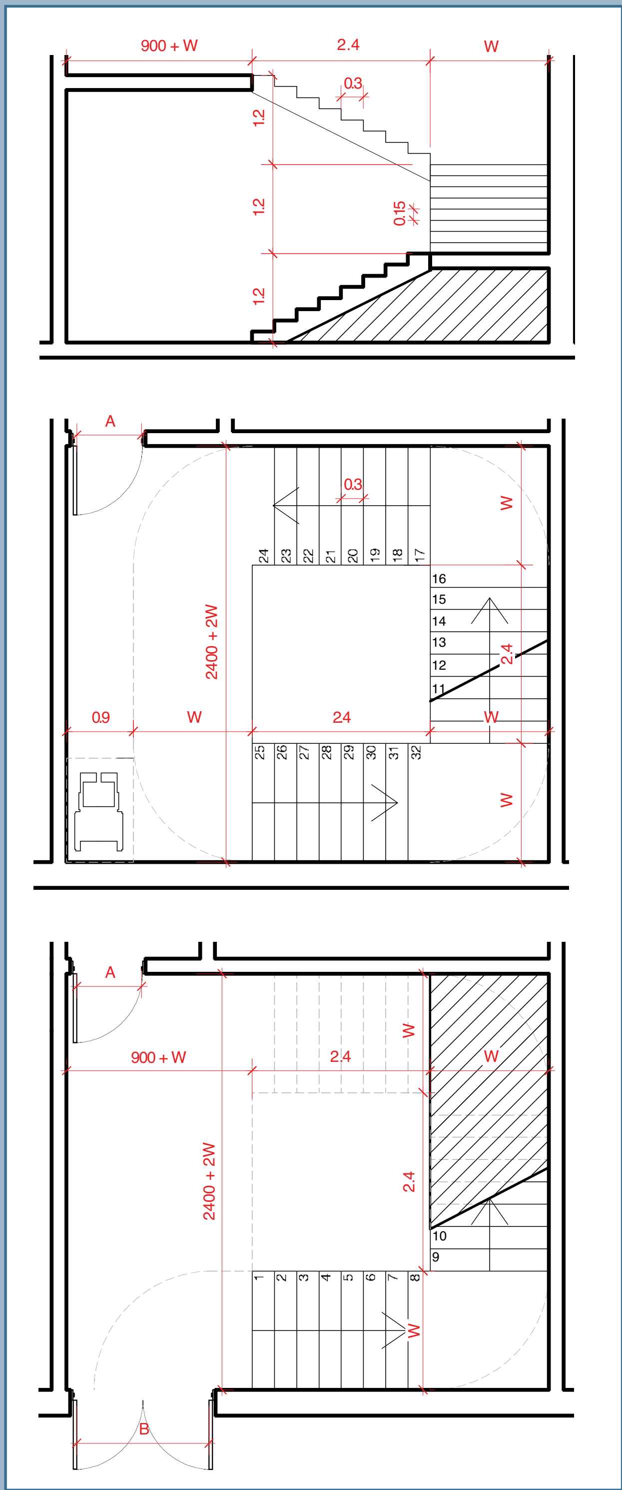
B indicates the escape stair final exit requirement.

Doors may be wider and single or double leaf as required by the brief. Depending upon the fire strategy for escape on ground floor, the final escape door from the stair may need to be equal in width to the aggregate of the stair width and the storey exit width. Doors must not swing into the zone of escape flow, defined by the dashed line.

In this design the storey exit door width at ground floor will affect the overall length of the stair enclosure. C indicates the dimension generated by the interaction with the zone of escape flow.

W refers to the structural width of the stair (not including handrails) and can be adjusted to develop this for wider or narrower alternatives.

Any area below flights with a headroom of less than 2.1m should be enclosed and is here shown hatched.

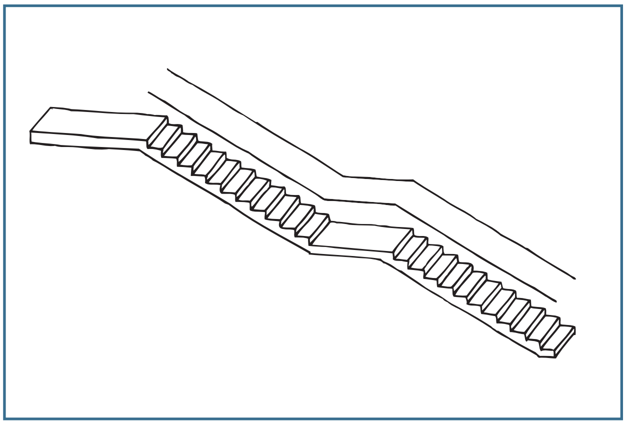


Type D stairway: Straight flight

A simple and very commo stair configuration. Each flight has 12 risers and could be designed as identical pre-fabricated units.

The overall length of this stair may preclude its use in many situations; however it may be useful in a location where space is restricted in some way. A staff space at the bottom of the stair would enable very efficient use supervision.

This has the smallest floor area of the four types of stair of around 20 sq.m. for a width of 1600mm, but it does not include exclude the space for a disabled refuge.



Type D stairway: typical dimensions

This layout is based on a 1600mm wide stair with the DCSF's preferred 150mm rise and 300mm tread.

Minimum escape door widths are determined by the detailed fire strategy for an individual school.

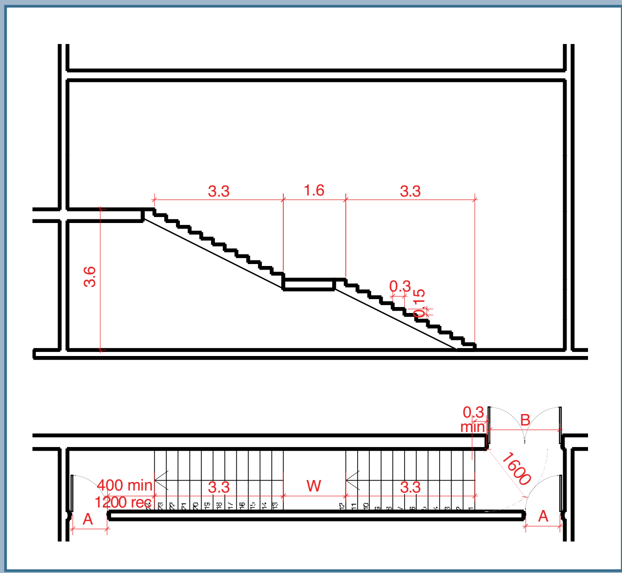
A indicates the storey exit requirement.

B indicates the escape stair final exit requirement.

Doors may be wider and single or double leaf as required by the brief. Doors must not swing into the zone of escape flow, defined by the dashed line. Part K of the Building Regulations requires a 400mm minimum between a door at the top of the stair and the top tread. This is still a very small distance and increasing the distance to 1200mm would improve the safety of this design.

The overall length of this design is dependent upon the required fire door widths and their interaction with the escape flow zone. If the fire strategy requires a disabled refuge in this staircase it would be necessary to increase the overall length of this design to accommodate the number of refuge spaces required under the fire strategy.

W indicates the structural width of the stair (not including handrails) and can be adjusted to develop this for wider or narrower alternatives.



4

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This document was published in February 2008. After this date readers should ensure they use the latest edition of all references.

Legislation

- Building Regulations:
  - Part B: Fire Safety
  - Part K: Protection from Falling, Collision and Impact
  - Part M: Access to and Use of Buildings
- Disability Discrimination Act 1995

DCSF Guidance

- BB 77 Designing for Pupils with Special Educational Needs and Disabilities in Schools
- BB 91 Access for Disabled People to School Buildings: Management and Design Guide
- BB 93 Acoustic Design of Schools
- BB 94 Inclusive School Design
- BB 100 Design for Fire Safety in Schools
- BB 101 Ventilation of School Buildings

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