

**Health and Safety Executive
Technology Division**

SPECIALIST INSPECTOR REPORTS

7-SEP-1990 BLDSC BOSTON_SPA
LS23 780
SPECIALIST INSPECTOR REPORT - HEALTH AND
SAFETY EXECUTIVE TECHNOLOGY DIVISION



8404 767700 ISSU 15
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**DESIGN LOADINGS FOR TEMPORARY ROOF
AND FLOOR EDGE PROTECTION**

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Report No. 15 September 1988

ERRATUM

Summary Page - First line should read "design of new equipment and for assessing existing devices".

The Health and Safety Executive employs a wide range of qualified and experienced Specialist Inspectors who, in the course of their work, acquire a substantial amount of information and expertise about workplace hazards. Much of this is used in the preparation of official HSE Guidance Notes and formal advice. However, other material which might be less developed could contain useful ideas and be helpful to people involved in health and safety. Such material could also stimulate discussions about problems and their solutions and encourage others to come forward with ideas and practical improvements. Specialist Inspector reports are designed to publish this material.

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**DESIGN LOADINGS FOR TEMPORARY ROOF
AND FLOOR EDGE PROTECTION**

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SUMMARY

This paper presents loadings to be used in the design of new equipment for assessing existing devices. The paper brings together various items published by British Standards Institution and the Health and Safety Executive.

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DESIGN LOADINGS FOR TEMPORARY ROOF AND FLOOR EDGE PROTECTION

1. INTRODUCTION

Every temporary roof or floor edge where a person is liable to fall more than 2 m must be provided with a suitable guard rail of adequate strength.

2. Although this legal requirement for the provision of edge protection exists, it was not until 1981 that anything was laid down with regard to the forces that such protection should sustain. In the past the normal standard of protection was based on that provided by the Construction (Working Places) Regulations 1966 ie scaffold tube standards 1.0 to 1.2 m above the platform or roof level, 2.5-3.0m apart, with a further scaffold tube fixed at the top of the standard. Brick guards and mid height rails were sometimes incorporated into temporary edge protection and where no parapets existed toe boards were used.

3. Standard steel scaffold tubes in this country were 48.3mm in diameter with 4.0mm thick walls but tubes with 3.2mm thick walls are also available as well as standard 48.33mm diameter, 0.4mm thick aluminium tubes. With the introduction of aluminium lightweight scaffold towers a different tube is now available, 50mm in diameter with a wall thickness of 1.6mm. Dependent on what tube is used the structural strength of the system will vary.

4. For suspended access equipment two British Standards exist to cover the design of the equipment, BS 5974 for temporarily erected access and BS 6037 for permanently installed equipment. These standards give design figures for the cradles including the edge protection around the cradle. The Working Places Regulations have requirements for non-powered suspended access again with no specified requirements for the forces involved. The design of the cradles is covered by BS 2830.

5. A number of manufacturers have produced purpose made equipment for use as specialised chimney scaffolds as well as self supporting edge protection for flat roofs and slung platforms for the edges of pitched roofs. It is preferable in order to design this equipment that there are recognised levels of loading.

6. OTHER AVAILABLE DOCUMENTS

British Standards Institution in their document DD72: 1981 was the first to lay down forces for the design of guard rails and standards of scaffolds, and suggested that protection capable of filling the space between guard rail and toe board should be incorporated such that the risk of people and large objects falling through is prevented. Nevertheless no forces for the design of this infill were given.

7. In 1982 British Standards Institution published BS 6180 which attempted to put into one document the design requirements for balustrades and barriers for buildings, sports stadia and car parks ie to cover both pedestrians and vehicles. The standard not only deals with the forces involved but also lays down deflection criteria and the maximum size of gaps permitted in the barrier. It refers to a number of materials and includes fixings and connections. British Standards Institution also published BS 5395 in 1985 and this covers permanent walkways and stairs in factory and industrial premises.

8. BASIS OF FORCES RECOMMENDED

Inspectors are asked for their recommendations for loading by designers and manufacturers who are seeking to market safety equipment. This report is used to publicise the figures that the Executive has been advocating in discussing the design of new equipment. It is assumed that the weight of a man is 90 kg and the forces given below are based on tests carried out at various times.

9. Consideration was given to the tests on safety belts and harnesses where forces are high because of the need to take into account the dynamic effect of rapid deceleration. Apart from a variation in the forces suggested regarding pitched and flat roofs, it is thought that dynamic forces as such need not be considered. In the event of a person falling down a pitched slope it is unlikely that the level of dynamic force can reach that used in fall arrest equipment design but some allowance has been made in the figures used for pitched and flat roof protection.

10. FLAT ROOF AND FLOOR EDGE BARRIERS UP TO 10° PITCH

Such barriers will include those free standing at the edge of a roof as well as slung access platforms which hang at the edge of a roof. The system should be tested using the loadings shown below. The test loads should be applied either to the unit being designed or, if used in continuous lengths, to a 6m length.

(a) (i) A point load of 0.7 kN without fracture or disconnecting and a displacement from an original line not greater than 100 mm.

(ii) A point load of 0.3 kN applied to the guardrail with an elastic deflection limited to 35 mm.

(b) Both loads should be applied separately in the most unfavourable position and direction, consistent with normal use of the equipment.

(c) Fracture or disconnecting is deemed to include:

(i) that there is no loss of stability by sliding or overturning in a free standing system, and

(ii) the permanent structure or component to which a fixed system is attached or on which it is supported is not damaged.

(d) The deflection limit of the guardrail under the 0.3 kN load is that of a length of guardrail relative to its fixing points and is not intended to include deflection of the supports or supporting structure.

(e) There are other more practical points that should be considered also. For example, it is unlikely that stresses and deflections will be kept within acceptable limits if the distance between guardrail supports much exceeds 2.0m.

(f) In paragraph c(ii) consideration must be given to the fact that there may be a weak link at the point of attachment to the structure. Either the fixing itself may be found to be inadequate or failure occurs in the element(s) of structure supporting the load. Examples being the tearing out of screws from timber under tensile load or inadequate brick work to resist the forces imposed.

(g) Testing must take into account the fixings, if any, on to the permanent structure and simulations of such connections must be included in the tests.

11. PITCHED ROOF EDGE BARRIERS OVER 10° PITCH

The requirements are as given for flat roof edges except the following figures are used in lieu of (a)(i).

12. A point load of 1.25 kN applied without breaking or disconnecting and without displacement from an original line by more than 200mm.

13. COVERS

Covers such as trap doors may be incorporated in equipment. When a person stumbles and falls from within their own height the impact can be translated as being equivalent to a 45 kg sandbag dropping 1.2m. This should be used when designing covers and frames in any equipment.

REFERENCES

The Construction (Working Places) Regulations 1966

DD7 2 : 1981 Draft for Development
Design requirements for access and working scaffolds

BS 6180 : 1982 British Standard Code of Practice
Protective barriers in and about buildings

BS 5395 : Part 3 : 1985 British Standard
Stairs, ladders and walkways
Pt 3. Code of practice for the design of industrial
type stairs, permanent ladders and walkways

BS 2830 : 1973 British Standard
Suspended safety chairs and cradles for use in the
construction industry

S(G) 33 Booklet : Safety in Roofwork
Health and Safety Executive