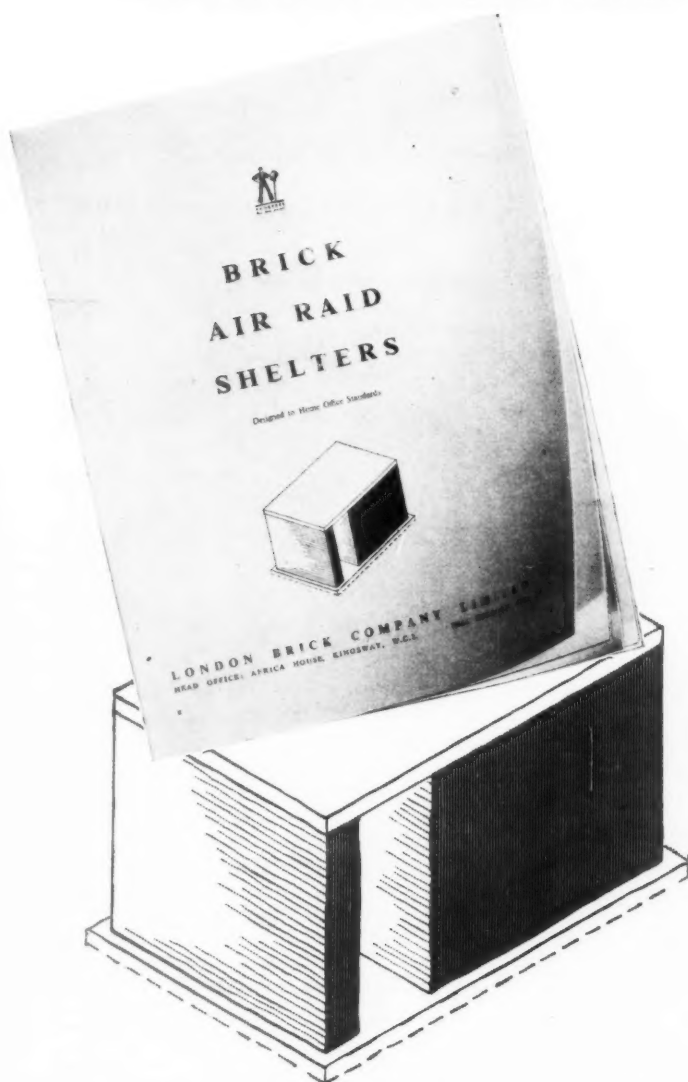


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# THE ARCHITECTS'



## JOURNAL

THE ARCHITECTS' JOURNAL  
WITH WHICH IS INCORPORATED THE BUILDERS'  
JOURNAL AND THE ARCHITECTURAL ENGINEER,  
IS PUBLISHED EVERY THURSDAY BY THE ARCHI-  
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*The Editor will be glad to receive MS. articles  
and also illustrations of current architecture in this  
country and abroad with a view to publication.  
Though every care will be taken, the Editor cannot  
hold himself responsible for material sent him.*

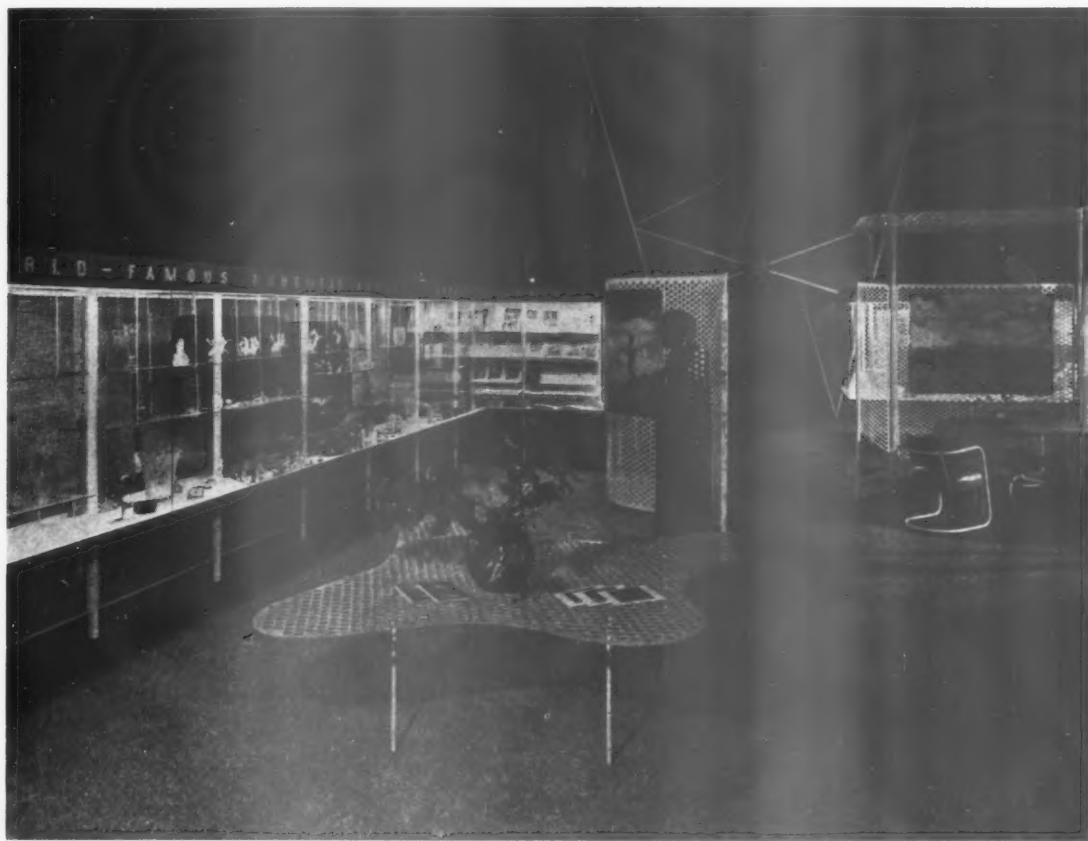
## TESTING INCENDIARY BOMBS



A series of tests were recently carried out at Rochester in which various building components were tested to establish the effects of thermite bombs.

The top photograph shows a lath-and-plaster ceiling being tested. The ceiling was covered with a patent heat-insulating powder, and the ceiling itself remained unaffected. In the lower photograph a section of R.S.J. cased in 2 in. concrete is shown. Sparks were thrown to considerable distances, but little damage was done to the casing. In a second test of a similar kind, however, the joist was considerably damaged.

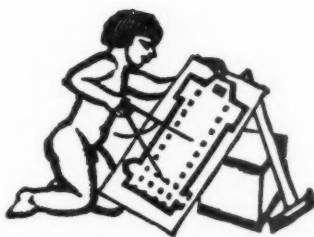




## AT SAN FRANCISCO

*The Czechoslovak exhibit at the San Francisco Exhibition had just been completed at the time of the German invasion of Czechoslovakia. The exhibit was designed by Antonin and Charlotta Heythum. Materials are chiefly glass, light steel and perforated sheet metal, and flooring is of light grey and brown linoleum. Colours are white and light blue, and information lettering is red. The photographs show one of the bays and a detail of a showcase.*





## OFFICIAL A.R.P.

**T**HE whole of this and the following issue of the JOURNAL are devoted to explaining the Government's policy for protection against aerial bombing as it is laid down in official publications.

There are two main reasons for these special issues.

The first is that the Civil Defence Bill, which is likely to become law within the next week or so, will make it compulsory for local authorities, landowners and employers to provide certain standards of protection against air raids. And in addition, the work of constructing the required shelters will have to be begun by a certain date (probably by the end of September) if a grant towards their cost is to be obtained. This makes it certain that the construction of shelters on a very large scale will take place in the next three months.

The second reason for these issues is the present difficulty of answering the questions: What are the standards of protection which are officially recommended? And which, in varying circumstances, is the best way of providing them?

It is to answer these questions as fully as possible that these two issues have been designed. The standard of protection aimed at by the Government is that of protection against the direct or indirect effects of a 500-lbs. high explosive bomb bursting 50 feet or more away. This is the main element of the Government's policy—protection against gas and incendiary bombs is regarded as highly desirable but of less relative importance.

In the last year a great deal of discussion has taken place over this so-called "blast and splinter proof" policy. Even more discussion has arisen over whether it would not be better for the A.R.P. Authority for each area to make all surveys, prepare all schemes for shelters and superintend the execution of such shelters; thus entrusting a single authority with sole responsibility for all branches of Passive Defence. These

discussions have no place in this and next week's issue, which are concerned with what will happen in the next three or six months.

In this period the Government will look to private enterprise (supplemented by local authorities) to provide shelters of the required standard, it will give grants for the purpose and the duty of architects and engineers will be to provide shelters of the required standard in or near every imaginable type of dwelling or work-place.

To help them to do so, official departments have issued various publications, some outlining policy and methods and others dealing with one or many technical aspects of shelter design.

In the present issues of the JOURNAL these publications are listed, their provisions are explained, and suggestions are put forward for providing the required standard of protection in many different types of building.

But in the next few months clients will consult architects upon many points other than those of design and construction. The terms on which grants will be made towards the cost of shelters is only the most obvious among enquiries which will cover the whole statutory basis of A.R.P. For this reason the Civil Defence Bill is published at length in this issue, with explanatory notes, where these seemed required.

It is possible that changes may yet be made in the Bill before it is passed. But it is not probable that these will be large. In any case, a Supplement calling attention to any such changes will be published in a future issue of the JOURNAL, and will be cross-referenced to be read with the present special issues.

Architects, therefore, will have in today's and next week's issues a complete reference to the Government's shelter policy both as regards legislative and technical recommendations.



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## NOTES & TOPICS

### BLACKPOOL

LAST week I spent three days at Blackpool. It is an unusual and curiously stimulating experience to visit a town whose positive ugliness is so unrelieved by any picturesque quality, whether that of sooty mills and belching chimneys or of cobbled streets and lattice windows. But, as the railway guide remarks, the picturesque usually means insanitary conditions which would be no credit to a seaside resort. The attractions of Blackpool, therefore, are frankly modern, artificial and organised.

★

The town, of course, was not yet in full swing. The change-man on the pier, for instance, had no coppers, and the palmist's kiosk was closely shuttered—on the promenade, however, there was great activity, and a general atmosphere of a new cinema on its opening day. In the amusement arcades girls with hair like gilded brussels-sprouts groomed the electric pin-tables. Gardeners tended the floral cuckoo clock. Painters cleaned down the old windmill which crowns the public lavatories. Scenic artists, their brushes moving with horrifying confidence and speed, covered acres of wallboard with scenes from Italian lakes, Spanish patios, or Japanese gardens. Only a Bavarian village was needed to complete the painted Axis. Within a few days the torrent of holiday-makers was to begin.

★

In the Pleasure Beach, preparations for the season were almost completed. All the buildings had been painted white, picked out in clear bright colours, and they looked as gay and brittle as toys in a shop window. This amusement park is remarkable as much for its design and lay-out as for the ingenuity of its "rides." For some years the supervising architect has been Mr. Joseph Emberton, and under his control the place is gradually being sorted out and rebuilt. Some of the buildings have already been

illustrated in the JOURNAL; the latest one, the new circular Casino, has just been finished.

★

It is an openly planned, sunny building, full of light and colour, whose main feature is a dramatically curved staircase sweeping up within a sheath of glass. The management await the holidaymakers' reactions to this building with confidence, for the success of the re-planned Pleasure Beach has shown that good design is genuinely appreciated. Perhaps Blackpool in general will take the hint.

### TASTE AND THE PUBLIC

The public's reputation for dislike of any design which is not vulgarly bad has lasted long. There are now some indications that an improvement has set in.

★

It is tempting to quote the Vigilance Committee results as an example: but those laymen were chosen for their eminence, and therefore in some degree for their intelligence. Another, more significant, is the improvement—small but real—in the design of cheaper textiles and furniture. A third is a letter I have had from one who was able to hear what the public did and didn't like about the All-Europe House at the Ideal Home Exhibition. Here are two extracts from a letter from Mrs. C. G. Tomrley.

"On one thing one and all were unanimous. This was the folding mullionless windows, 8 ft. wide. 'I do like those windows' or 'Those windows are what I like' were two stock phrases so common that it left one marvelling that standardisation had so spread to appreciative comment. The delight in open-airiness was surprising in itself, coming as it did before summer had coloured people's consciousness, and from people who were obviously thinking in terms of ordinary town districts. It sounded like a real recognition of a long-felt need, and it left the writer convinced that the introduction of such windows anywhere in the south, and probably almost anywhere else, would instantly sell a house."

"The feature most delighted in after the windows was the cupboard space, an enormous, unheard-of amount. Why builders have not already exploited cupboard-walls sound-insulated with some inexpensive product like thermacoust, here used, is only to be explained on the somewhat improbable ground that they have come to an understanding with the makers of wardrobes. The usual practice, however, rather discourages the idea of collusion, since the only cupboard is in the best bedroom, where also is the fine wedding present suite from mother, complete with 4-ft. 'robe.' It has become the writer's firm conviction that the public is getting ready for a change in the aspect and feel of their homes, now so relentlessly conditioned by the builder's windows and fireplaces and the furniture manufacturer's suites. The change will not come from the furniture trade for obvious reasons. Perhaps builders will suddenly wake up and cash-in on this awakening public consciousness that they are not getting all they might."

These comments are significant because they are positive. It is probably optimistic to think that they herald the birth of a popular style, but the possibility seems a little less remote. For once interest is aroused and opinion formed, judgment and taste eventually may follow.

★

An experimental exhibit like the All-Europe House, sane, sincere, immaculately planned and detailed, does more good than years of preaching lectures or a hundred little doctrinaire exhibitions, however saucily their slogans and montages are arranged. Miss Denby and her collaborators should be congratulated on having aroused with their design such opinions from the public.



*A photograph sent to Astragal by a reader who was impressed by a Council's determination to put the matter beyond all doubt.*

#### CURE GUARANTEED

I am glad to announce that Sir Alison Russell's guaranteed never-smoky triangular fireplace has not caught us all out.

★

Mr. Peter Smith writes :—

I can support the statement that it is a cure for smoke entering the room, and I have found this in about 30 or 40 cases where I have used the form. It occurred to me as a result of various considerations regarding heat reflection and elimination of cold corners as a simple and logical device. In addition to the above cases, which are new work, I have used the form successfully in altering old fireplaces complained of as smoking. Personally, I think it has advantages additional to that of not smoking, and I always use it where my client is not of a more cautious and suburban character.

★

Mr. Edgar Bunce says that he has designed a number of similar fireplaces and none of them have smoked. But he adds : "On the other hand, neither have any of the fireplaces I have designed on more usual lines." This seems almost asking for trouble.

★

Mr. Bunce also thinks the triangular shape has several advantages besides non-smokiness: it is cheap, it is suitable for coal or wood fuel and for a small or large fire.

★

He adds that the smoke tends to rise close to the angle at the back and for that reason the shape may be a good cure for a smoking chimney.

★

That is my explanation of the possible rightness of Sir Alison's claim—that the shape tends to provide the fire with a patent self-enlarging flue in which the draught is always sufficient. But I want official, *scientific* endorsement and more successful examples. Everyone who has designed a triangular fireplace is now asked to tell me what happened.

#### PARTNERSHIPS

The very capable and thoroughly worked out scheme by Mr. Richard Sheppard and Miss Jean Shufflebotham which won the Camps Competition has also the distinction of being the second competition to be won by a husband and wife partnership. (I am also told that the calculations of cost and constructional methods were prepared in collaboration with Messrs. Davis and Belfield, who are responsible for the JOURNAL'S PRICES. The old firm. . .)

★

This reminds me that mixed partnerships where only the initials of partners are given sometimes leads to difficulties. Some months ago I dictated to a new secretary a letter to, let us say, K. M. Watson and J. V. Brown. I said I was writing to Miss Brown, and in the course of the letter referred to "Your husband." The secretary asked my assistant if I were always like that after lunch.

#### BETJEMAN

One of Mr. John Betjeman's very best contributions to common decency (C.P.R.E., S.P.A.B., G.G. please note) has just been published under the title "Antiquarian Prejudice." Hogarth Press (price 6d.). This pamphlet reminds one again that Mr. Betjeman is almost the only contemporary literary gentleman who writes sense as well as English about architecture, whether eighteenth century, PERP, modern. This is because he has been blessed with eyesight as well as insight. The result, needless to say, is that he is regarded by the public as a knock-about comedian, and by the profession as a dangerous character. Consider the following :

There is much to say about antiquarianism in relation to ecclesiastical building, despite the fact that more churches seem to be pulled down than put up. Though it is not the authoritative opinion of the Church—vide the Seventh Report of the Central Council for the Care of Churches—it seems to be the æsthetic opinion of the bishops, especially the Bishop of London, that causes only eighteenth- and early nineteenth-century churches to be pulled down, and of them we have too few examples. But those of you who have visited episcopal palaces will know the cheerful chintzes, the Oxford frames, the electroliers, the islands of mat that one leaps to, like George Israel jumping the ice-floes with the Moravian Gospel to Poland, on one's way from bed to the brass can of tepid water ; you will know the taste in leather-work of the Bishop's wife, the cork mats on the refectory table ; you who know these—for what is an episcopal palace but the refectory spread thinly over a multitude of rooms?—you who know these, will not be surprised to hear that one Renaissance church has been demolished as "pagan," and that another has been scheduled for demolition.

★

Mr. Betjeman's genius, of course, is that he is "most amusing" when he is most in earnest. As a result, he is "not taken seriously," but on the other hand, unlike most other architectural writers, he is read. Mr. Betjeman ought to write a solid treatise : he has the facts, and he might produce a work so monumental that it would blow some of our knighted antiquarians right off their committees.

#### TAIL-PIECE

I was about to take a snap of the new extension of the Bodleian Library at Oxford on Monday last when two girls came into the line of vision with the same intention. After the blue-trousered one had taken the snap she turned to her friend and said :

"Isn't it amazing, Doris, how *new* so many of these buildings look."

Praise, indeed, Sir Giles.

ASTRAGAL



## NEWS

## ARCHITECTURAL ASSOCIATION

Following are the names of the Officers and Council of the Architectural Association, London, for the session 1939-40: J. Murray Easton, F.R.I.B.A. (President); Joseph Hill, F.R.I.B.A., F.I.A.R.B., M.I.STRUCT.E. (Vice-President); Arthur W. Kenyon, F.R.I.B.A. (Vice-President); R. E. Enthoven, F.R.I.B.A., A.A.DIPL. (Hon. Secretary); Vivian H. Seymer, D.S.O., M.C., A.R.I.B.A., A.A.DIPL. (Hon. Treasurer); Arnold Silcock, F.R.I.B.A. (Hon. Editor); S. E. Dykes Bower, F.R.I.B.A., A.A.DIPL. (Hon. Librarian); Verner O. Rees, F.R.I.B.A. (Past President). Ordinary Members of Council: Messrs. Richard Acland, M.P.; A. F. B. Anderson, F.R.I.B.A., S.A.D.B.; Henry Braddock, A.R.I.B.A., A.A.DIPL.; D. L. Bridgwater, B.A.R.C.H. (LVPL.), A.R.I.B.A.; Wells Coates, B.A., B.Sc., PH.D., F.R.I.B.A.; S. E. T. Cusdin, A.R.I.B.A., A.A.DIPL.; E. Maxwell Fry, F.R.I.B.A.; Christopher Nicholson, M.A.; E. B. O'Rourke, M.A. (CANTAB.), A.R.I.B.A.; and B. Clough Williams-Ellis, M.C., J.P., F.R.I.B.A.

Mr. John Murray Easton was born in 1889. He was educated at Aberdeen Grammar School and received his architectural education in Scotland and at the University of London. He is a partner in the firm of Stanley Hall and Easton and Robertson. In 1927 Mr. Easton was awarded the Godwin Bursary and took as his subject for research "Health and Recreation Centres in Europe." He has served on the Council of the Architectural Association since 1936, and was Vice-President in the session 1938-39.

## R.I.B.A. ELECTIONS

Following is the list of nominations for the R.I.B.A. Council. The ballot papers must be returned to the R.I.B.A. by next week.

## Nominated by the Council

Members of Council: J. R. Adamson, C. L. Gill, F. R. Hiorns, L. H. Keay, A. H. Moberley, T. E. Scott, M. T. Waterhouse, G. C. Wilson.

Associate Members of Council: D. L. Bridgwater, W. A. Daft, Professor W. G. Holford, C. A. Minoprio.

Licentiate Members of Council: F. A. Broad, Sir William F. V. M. Milner, C. B. Parkes.

## New Nominations

Members of Council: C. H. Aslin, Victor Bain, P. J. Bartlett, J. Bennett, H. R. Collins, F. J. Horth, J. D. Hossack, G. H. Jenkins, S. D. Meadows, J. N. Meredith, R. G. Roberts, C. H. Stillman, J. B. Surman, John Swarbrick, E. A. Verger.

Associate Members of Council: J. T. Castle, C. E. Culpin, D. E. E. Gibson, R. O. Harris, R. A. H. Livett, R. G. Manning, J. A. Pinckhead, Winston Walker, W. H. Wingate.

Licentiate Member of Council: Malcolm MacTaggart.

## ARCHITECTS AND THE TERRITORIAL ARMY

The R.I.B.A. Emergency Panel has had under consideration the position of architects who desire to join the Territorial Army. The Panel is advised that the most appropriate units are Divisional or Corps Troops Engineers or the Royal Artillery. It has also been explained that there are other units in which architects' qualifications would be of value.

Architects not resident in the London area are advised to approach the Secretary of the Local Territorial Army Association,

## THE ARCHITECTS' DIARY

## Friday, June 2

TOWN PLANNING INSTITUTE. At Carlton Hall, Carlton Street, S.W.1. "The Location and Design of Parks and Playing Fields." By E. Prentice Marston. 6 p.m.

ROYAL INSTITUTE OF ARCHITECTS IN SCOTLAND. Annual Convention. At Peebles.

## Monday, June 5

CHARTERED SURVEYORS' INSTITUTION. At George Street, S.W.1. Annual General Meeting. 5 p.m.

## Tuesday, June 6

NATIONAL HOUSING AND TOWN PLANNING COUNCIL. London and Home Counties Conference. At County Hall, S.E.

## Wednesday, June 7

R.I.B.A., 66 Portland Place, W.1. Exhibition of the collection of architectural drawings and water colours by John Sell Cotman. Until June 28.

whose address may be found in the local Telephone Directory under the heading, "Territorial Army."

Architects resident in or near London are advised to apply to one of the following Territorial Units, but it is understood that many of these units are already up to strength:

The London Divisional Engineers: Duke of York's Headquarters, Chelsea, S.W.3.

The London Corps Troops Engineers: 10 Victoria Park Square, Bethnal Green, E.; 7 Linden Grove, Nunhead, S.E.

53rd (London) Medium Regt., R.A.: Drill Hall, Offord Road, Barnsbury, N.1.  
98th (Surrey and Sussex Yeomanry) (Queen Mary's) Army Field Regt., R.A.: Melbourne House, King's Avenue, Clapham Park.

97th (Kent Yeomanry) Army Field Regt., R.A.: Drill Hall, Union Street, Maidstone; Drill Hall, St. Peter's Lane, Canterbury; Drill Hall, Ashford; Yeomanry House, Bromley.

92nd (5th London) Field Regt., R.A.: 76 Lower Kennington Lane, S.E.11; 10 Beresford Street, Woolwich, S.E.18.

91st (4th London) Field Regiment, R.A.: Ennerdale Road, Lewisham, S.E.13.

90th (City of London) Field Regt., R.A.: Artillery House, Handel Street, Bloomsbury, W.C.1.

86th (East Anglian) (Herts Yeomanry) Field Regt., R.A.: Riding School, St. Albans; 28 St. Andrew's Street, Hertford; Bearton Camp, Hitchin.

85th (East Anglian) Field Regt., R.A.: Artillery House, The Green, Stratford, E.; South Street, Romford; Brook Road, Grays.

65th (8th London) Field Regt., R.A.: 43 Eltham Road, Lee, S.E.12; St. Margaret's Road, Plumstead, S.E.18.

64th (7th London) Field Regt., R.A.: Drill Hall, High Street, Fulham, S.W.6; Wood Lane, Shepherd's Bush, W.12; Porteous Road, Paddington, W.2.

104th (Essex Yeomanry) Regt., Royal Horse Artillery: Market Road, Chelmsford; 17 Stanwell Street, Colchester; Tenterfield Road, Malden; Ongar Road, Brentwood; York Road, Southend-on-Sea.

11th Regt., Royal Horse Artillery: Armoury House, City Road, E.C.1.

## IN PARLIAMENT

Mr. Sorensen asked the Minister of Health whether, in view of the increasing danger of the spoliation or destruction of places of

natural beauty in Great Britain, particularly arising from the incidence of rearmament and similar activities, he would consult with appropriate organizations, both of a voluntary and municipal character, with a view to the making of a national survey of such places and the operation of swifter and more effective safeguards.

Mr. Elliot said he did not consider that a national survey for the purposes suggested would be of real use in present circumstances. The whole question of the preservation of the countryside had recently been under consideration by the Town and Country Planning Advisory Committee. In accordance with their advice he was taking measures to secure that fuller use was made of the existing powers of control.

Mr. Stokes asked the Lord Privy Seal whether he was aware that the cost price of the standard unit steel shelter, the total weight of which was 8½ cwt., exclusive of distribution charges but including profit, should not exceed £5; and how many such shelters had his department ordered.

Sir J. Anderson said that the production costs of the steel shelter were subject to investigation by the Import Duties Advisory Committee, and he was satisfied that the estimated average price was reasonable. That price included, of course, a substantial item representing cost of fabrication. The number of standard units ordered to date was 1,400,000.

## NEWS IN BRIEF

● The Middlesex County Council has informed the Ministry of Transport that it will be unable to proceed with any of the highway improvement schemes included in the Bressey survey unless the Ministry offers a grant of 75 per cent. of the cost.

● Mr. E. Allan Heppenstall, a post-graduate student of Leeds School of Architecture, Leeds College of Art, has been awarded the Bedford Scholarship by the West Yorkshire Society of Architects. The scholarship, with an annual value of £60, is awarded for travel and research in architecture.

● Mr. J. H. Forshaw, M.C., F.R.I.B.A., chief architect to the Miners' Welfare Committee, has been recommended by the General Purposes Committee of the L.C.C. for the post of Deputy Architect to the Council.

● Mr. W. B. Rolfe, L.R.I.B.A., the Bath architect, has taken into partnership Mr. C. A. Crozier Cole, A.R.I.B.A. The future style of the firm will be Rolfe and Crozier Cole.

● Mr. Kenneth E. Curry, A.A.DIPL. A.R.I.B.A., announces that, owing to the retirement of his partner, Mr. Frank T. Winter, F.R.I.B.A., he has entered into partnership with Mr. G. Lawrence M. Jenkins, A.R.I.B.A., the practice being continued under the name of Jenkins and Curry, chartered and registered architects and surveyors, 6 Old Bond Street, London, W. 1.

● The Bradford Corporation City Architect's Department Sub-Committee has decided to recommend the appointment of Mr. Harold Conolly, acting City Architect, as City Architect, in succession to Mr. J. A. Fletcher, who retired recently.

● Mr. G. Turner, F.R.I.B.A., of Crossways, Goring-on-Thames, left £49,364 (n.p. £47,950).

● The latest date for submission of entries in the Incorporated Clerks of Works Association of Great Britain's examination for Part 1 and 2 is June 10.

# The Architects' Journal Library of Planned Information

## INFORMATION SHEET SUPPLEMENT



### SHEETS IN THIS ISSUE

**735** Plumbing

**736** Structural Steelwork



*All the Information Sheets published in The Architects' Journal Library of Planned Information since the inception of the series to the end of 1938 have been reprinted and are available in five volumes. Price 21s. each.*



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- 705 : Metal Work
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- 707 : Furniture Layout
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- 709 : Flue Construction
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- 712 (109 revised) : Quarry Tiles
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- 728 : Timber Construction
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- 732 : Concrete Construction
- 733 : Structural Steelwork
- 734 : Metalwork





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TABLES 1-4 set out the minimum weights per lineal yard of lead pipes for various purposes, as revised by the British Standards Institution, March 20th, 1939. The weights given are for lead pipes, & not ternary or tellurium alloys.

TABLE 1 : SUPPLY AND DISTRIBUTING PIPES :

| INTERNAL DIAMETER :                                                                                          | 3/8 in. | 1/2 in. | 3/4 in. | 1 in. | 1 1/4 in. | 1 1/2 in. | 2 in. |
|--------------------------------------------------------------------------------------------------------------|---------|---------|---------|-------|-----------|-----------|-------|
| MIN. WEIGHT IN LBS. PER LIN. YARD                                                                            |         |         |         |       |           |           |       |
| (a) for pressures not exceeding 150 ft. head of water (65 lbs./sq. in.)                                      | 4.5.    | 6.      | 9.      | 12.5. | 16.       | 20.       | 28.   |
| (b) for pressures exceeding 150 ft. head of water but not exceeding 250 ft. head of water (108 lbs./sq. in.) | 5.      | 7.      | 11.     | 16.   | 21.       | 27.       | *     |
| (c) for pressures exceeding 250 ft. head of water but not exceeding 350 ft. head of water (152 lbs./sq. in.) | 6.      | 9.      | 15.     | 21.   | 28.       | †         | .     |

\* The maximum permissible working pressure for this size and weight of pipe is 225 ft. head of water (97 lbs. per sq. in.)

† The maximum permissible working pressure for this size and weight of pipe is 325 ft. head of water (141 lbs. per sq. in.)

TABLE 2 : FLUSHING AND WARNING PIPES :

| INTERNAL DIAMETER :                      | 1/2 in. | 3/4 in. | 1 in. | 1 1/4 in. | 1 1/2 in. | 2 in. |
|------------------------------------------|---------|---------|-------|-----------|-----------|-------|
| MINIMUM WEIGHT IN LBS. PER LINEAL YARD : | 3.      | 5.      | 7.    | 9.        | 12.       | 16.   |

TABLE 3 : SOIL, WASTE, AND SOIL AND WASTE VENTILATING PIPES :

| INTERNAL DIAMETER :                      | 1 1/4 in. | 1 1/2 in. | 2 in. | 2 1/2 in. | 3 in. | 3 1/2 in. | 4 in. | 4 1/2 in. | 5 in. | 6 in. |
|------------------------------------------|-----------|-----------|-------|-----------|-------|-----------|-------|-----------|-------|-------|
| MINIMUM WEIGHT IN LBS. PER LINEAL YARD : | 7.        | 9.        | 12.   | 14.4.     | 17.1. | 20.       | 22.8. | 29.1.     | 41.   | 57.   |

TABLE 4 : GAS AND CONDENSATION PIPES :

| INTERNAL DIAMETER : |                                    | 3/8 in. | 1/2 in. | 5/8 in. | 3/4 in. | 1 in. | 1 1/4 in. | 1 1/2 in. | 2 in. |
|---------------------|------------------------------------|---------|---------|---------|---------|-------|-----------|-----------|-------|
| GAS.                | MIN. WEIGHT IN LBS. PER LIN. YD. : | .       | 3.      | 3.5.    | 5.      | 7.    | 9.        | 12.       | 16.   |
| CONDENSATION.       | Ditto.                             | 1.5.    | .       | .       | .       | .     | .         | .         | .     |

## HOT WATER DISTRIBUTING PIPES :

The above tables give weights of lead piping for use on cold water installations only. For notes on weights of lead piping for hot water installations, see the reverse side of this Information Sheet.

Information from Lead Industries Development Council. (Tables 1 to 4 above are extracted from B.S.S. 602/1939, by permission of the British Standards Institution.)

INFORMATION SHEET : CURRENT WEIGHTS OF LEAD PIPES : N° 57.  
SIR JOHN BURNET TAIT AND LORNE ARCHITECTS ONE MONTAGUE PLACE BEDFORD SQUARE LONDON WC1

THE ARCHITECTS' JOURNAL  
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## INFORMATION SHEET

• 735 •

### PLUMBING

**Subject :**

Pipe Sizes

**General :**

Tables 1 to 4 on this Sheet set out the minimum weights per lineal yard of lead pipes for various operating pressures and purposes, as revised by the British Standards Institution in Standard Specification No. 602, 1939. They have been extracted by permission of the Institution, from whose Publications Department at 28 Victoria Street, London, S.W.1, the complete Specification can be obtained, price 2s. 2d. post free.

**Modifications :**

The following modifications have been introduced into the revised Specification :

(a) Composition : The chemical analysis is given in greater detail by including limits for copper, bismuth and tin.

(b) Grain : An additional clause is included in view of the importance of grain structure in lead pipe, which requires a cross section of the pipe, when examined, to show uniform grain. The method of examination is described in detail.

(c) Marking : The method of marking the pipe has been made more explicit.

**Revisions :**

The maximum water pressure under which the lightest weight cold water supply and distributing pipes may now be used has been

increased from 110 feet head to 150 feet head (65 lb. per sq. in.).

For medium weight pipes in the same category, pressures between those of 150 feet water head and 250 feet water head are permissible.

For the heaviest weights of the supply and distributing pipes, the maximum permissible pressure has been reduced from 400 feet water head to 350 feet water head (152 lb. per sq. in.). A weight is no longer given for piping of 2-in. internal diameter.

**Variations :**

It should be noted that the requirements of the several authorities throughout the country vary considerably, and the weights for pipes specified for different purposes, therefore, should be verified from the authority concerned.

**Hot Water :**

It should be remembered that the strength of lead is reduced to approximately one half when the temperature is raised from normal atmospheric temperatures to about 180 deg. F. or above. Where, therefore, a lead pipe is in service on a supply likely to be continuously heated to more than the normal temperature of domestic hot water, it is desirable to check the working pressure and, if necessary, to increase the weight of the pipe above that given in the B.S. Table, which is intended for use with water at atmospheric temperatures. The normal weights of pipe will usually be adequate on hot services fed from a storage tank, but may be inadequate on the hot side of an instantaneous heater fed direct from the main.

**Issued by :** Lead Industries Development Council

**Address :** Rex House, 38 King William Street, London, E.C.4

**Telephone :** Mansion House 2855



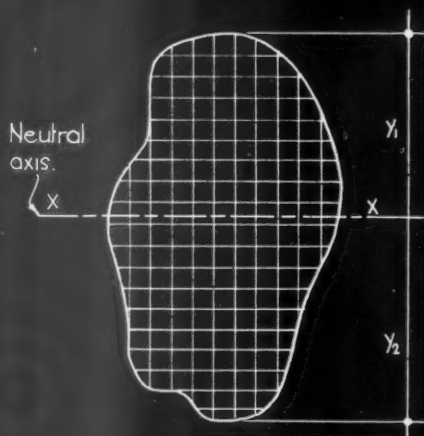




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## MECHANICS OF SECTIONS : N°2.

## © SECTION MODULUS.



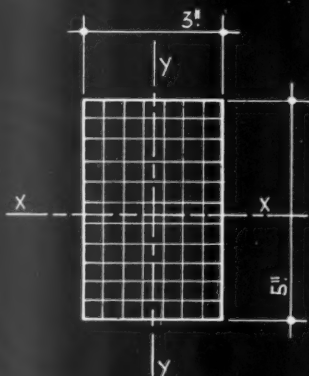
The section modulus,  $Z$ , is a mathematical convention adopted to facilitate the design of beams. It is the Moment of Inertia divided by the distance from the neutral axis of the extreme fibres.

$$\text{In General } Z = \frac{I}{y}$$

In irregular sections the distances to the extreme fibres on either side of the neutral axis are different (see figure.). Therefore, the section has two section Moduli about the same axis.

$$\text{Thus: } Z_1 = \frac{I_x}{y_1} \quad Z_2 = \frac{I_x}{y_2}$$

## © RADIUS OF GYRATION.



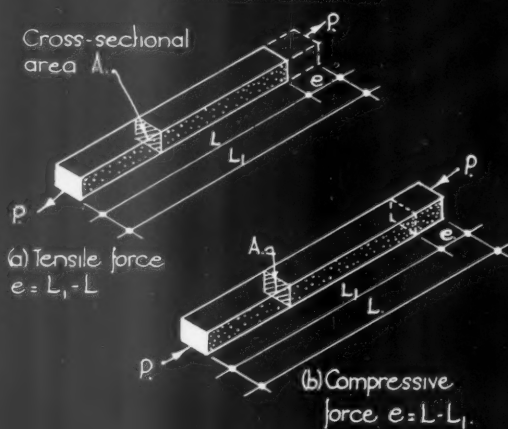
The radius of gyration,  $r$ , is a mathematical convention adopted to facilitate the design of columns. It is the square root of the Moment of Inertia divided by the area of section. In general the radius of gyration

$$r = \sqrt{\frac{I}{A}}$$

In a section having different Moments of Inertia about different axes there are also different radii of gyration about these axes.

Example:

| Axis. | $I$<br>ins. <sup>3</sup> | $A$<br>ins. <sup>2</sup> | $r$<br>ins. |
|-------|--------------------------|--------------------------|-------------|
| X.    | 31.25                    | 15                       | 1.44        |
| Y.    | 11.25                    | 15                       | .87         |

© MODULUS OF ELASTICITY.  
(LONGITUDINAL)

The modulus of elasticity is a mathematical convention adopted to facilitate the calculation of deflections in beams and the increase or decrease in length on an original length, when the load on a structural member is known.

In examples (a) and (b)

$L$  \_\_\_\_\_ original length.

$L_1$  \_\_\_\_\_ final length.

Stress \_\_\_\_\_  $\frac{P}{A}$

Strain \_\_\_\_\_  $\frac{e}{L}$

Modulus of Elasticity  $E = \frac{\text{Stress}}{\text{Strain}} = \frac{P}{A} \div \frac{e}{L} = \frac{PL}{Ae}$

Issued by Braithwaite & Co., Engineers, Ltd.  
Compiled by C.W. Homann, Consulting Engineer.

INFORMATION SHEET : STEEL FRAME CONSTRUCTION : N°3.  
SIR JOHN BURNETT TAIT AND LORNE ARCHITECTS ONE MONTAGUE PLACE BEDFORD SQUARE LONDON WC1

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## INFORMATION SHEET

• 736 •

STRUCTURAL  
STEELWORK**Subject :** Mechanics of Sections, No. 2**General :**

The series of Sheets on steel construction, of which this is the third, is not intended to cover the field of engineering design in steel, but to deal with those general principles governing economical design which affect or are affected by the general planning of the building. It also deals with a number of details of steel construction which have an important effect upon the design of the steelwork.

Both principles and details are considered in relation to the adjoining masonry or concrete construction, and are intended to serve as a guide in the preliminary design of a building so that maximum economy may be obtained in the design of the steel framing.

**Use of Section Modulus :**

The maximum or extreme fibre stress in a member is found by dividing the bending moment (which is set up by the external loads and which the section has to resist) by the section modulus.

**Example :—**

The bending moment is :

$$2000 \times 3 \times 11 = 72,000 \text{ lb. in.}$$

For a 5 in.  $\times$  2½ in. I the section modulus :  $Z_x = 4.364$ 

$$\text{Therefore the stress, } f = \frac{72,000}{4.364} = 16,500 \text{ lb. per sq. in.}$$

The calculated stress must not exceed the permitted working stress.

Alternatively for any permitted stress, when the bending moment has been found, the required section modulus can be found, by dividing the bending moment by the permitted stress.

**Example :—**If  $M$  (the bending moment) = 506,000 lb. in.and if  $f$  (permitted) = 18,000 lb. per sq. in.

$$\text{then } Z = \frac{506,000}{18,000} = 28.1$$

Therefore, either an 8 in.  $\times$  6 in. I ( $Z = 28.8$ ) or a 12 in.  $\times$  5 in. I ( $Z = 34.5$ ) would be satisfactory. The latter would, in most circumstances, be preferable because (i) it is lighter and (ii) on account of its greater depth (and greater Moment of Inertia) it offers greater resistance to deflection. To find the extreme fibre stress on either side of the neutral axis of irregular sections, the section modulus appropriate to that side must be adopted.

**The Use of the Radius of Gyration :**

Permitted stresses in columns and struts depend on the slenderness ratio, which is equal to the effective length of the strut, divided by the radius of gyration. The effective length depends on the condition of the end fixings of the column or strut, and in an irregular section the radius of gyration which gives the greatest value of the slenderness ratio (in any unsupported direction of the column or strut) must be adopted.

**Example :—**Assume 5 in.  $\times$  4½ in. I section, effective length 9 ft.

$$\text{Least value of } r = \frac{9 \times 12}{1.058} = 1.058$$

$$\text{Slenderness ratio } \frac{l}{r} = \frac{9 \times 12}{1.058} = 102$$

Permitted columns stress (under London County Council Building Bylaw 85)

$$= 3.7 \text{ tons per sq. in.}$$

$$\text{Area of 5 in. } \times \text{ 4½ in. I} = 5.882 \text{ sq. in.}$$

$$\text{Permitted load} = 3.7 \times 5.882$$

$$= 21.7 \text{ tons}$$

**Modulus of Elasticity :**

In an elastic material (such as steel at working loads) any deformation, as for example, compression or elongation which would result from a push or pull, is accompanied by internal stress which may be regarded for convenience as a pure compressive or tensile stress. This stress is always proportional to the amount of deformation. This is Hooke's Law—briefly, that stress is proportional to strain, i.e. deformation per unit length.

In order to come to comparable results for different materials it is necessary to adopt this definition of strain, for it is easily appreciated that for a constant stress (i.e. load or force per unit area of the cross section) the total deformation depends on the length. Thus the total deformation of a piece of material one yard long will be only half of that of a piece of the same material and of the same sectional area which is two yards long, yet which is subjected to the same force. There are also elastic deformations in other directions than that in the direction of the applied force ; but for the purpose of simplicity only the latter, i.e. the longitudinal behaviour will be considered here.

The relationship between stress and strain is constant for any given elastic material but it is different for different materials. Thus if a force of 1 lb. stretches a piece of rubber 1 in. a force of 2 lb. would stretch it 2 in.—provided of course that the load and consequently the stress was still within the elastic range of the material. There is a limit to the stress below which a material remains elastic but above which it becomes plastic. In the latter stage Hooke's Law no longer applies and certain deformation takes place which on relief of the load, remains as a permanent set or deformation ; but assuming the elastic limit not to be exceeded, the previously described behaviour would still obtain.

A piece of steel of the same original length and section as the piece of rubber and subjected to the same load (1 lb.) would not, however, stretch the same amount (1 in.)—but would stretch by an amount infinitely less—say  $x$  in. Nevertheless, for twice the load (i.e. under a force of 2 lb.) it would stretch by twice that amount—namely by  $2x$  in. provided again that the elastic limit had not been exceeded.

It follows that a measure of the elasticity of any material is the ratio of the stress to the strain—in other words, to the total load divided by the sectional area, divided by the deformation per unit length (i.e. the total deformation divided by the total original length). This ratio is called the Elastic Modulus or Modulus of Elasticity and is given the symbol "E."

Expressed algebraically, if

 $P$  = total force $A$  = cross sectional area $L$  = original length $e$  = increase in length

$$\text{then } E = \frac{PL}{Ae} \text{ See Figures E (a) and E (b).}$$

Since  $\frac{P}{A}$  is a stress (expressed, for example, as "lb.

per sq. in." or "tons per sq. ft." etc.) and  $\frac{e}{L}$  (or  $\frac{L}{e}$ ) is...

just a number, the value of  $E$  is expressed in terms of stress i.e. as lb. per sq. in., or tons per sq. ft.

The Modulus of Elasticity can also be regarded as the force which in a material of unit cross sectional area would (provided that it were possible for the material to remain elastic) produce a deformation equal to the original length of the material. That is to say if

$A = 1$ ,  $E = P$  when  $\frac{L}{e} = 1$ , i.e. when the deformation  $e = L$ , the original length.

**Use of the Modulus of Elasticity :**

(i) In calculating deflections (see Sheet No. 733).

(ii) When the load  $P$  on a structural member is known the increase or decrease in length on any original length,  $L$ , can be found from :—

$$e = \frac{PL}{AE} \text{ (inches or feet, etc.)}$$

Conversely if the change in length,  $e$ , on an original length  $L$  of a structural member is known then (a) the load on and (b) the stress in the member can be found from :—

$$(a) P = \frac{eAE}{L} \text{ (lb. or tons, etc.)}$$

$$(b) f = \frac{P}{A} = \frac{eE}{L} \text{ (lb. or tons, etc., per sq. in. or sq. ft., etc.)}$$

N.B.—Values must be expressed in comparable units. For instance if  $E$  is expressed in tons per sq. in., then  $P$  must be in tons, and  $A$  must be in sq. in. Since it is only the ratio of  $e$  to  $L$  which is important, they can both be expressed either in feet or in inches, etc., but in any individual equation they must be in the same units.

**Previous Sheets :**

The first two Sheets in this series are No. 729, Basic Steel Sections ; and No. 733, Mechanics of Sections, I

**Issued by :** Braithwaite & Co., Engineers, Ltd.**Address :** Horseferry House, Horseferry Road, London, S.W.1**Telephone :** Victoria 8571



# CIVIL DEFENCE - 1

## THE GOVERNMENT'S POLICY FOR A.R.P. STRUCTURES

AN ANALYSIS BY

FELIX J. SAMUELY AND CONRAD W. HAMANN

*M*ANY architects and engineers are now engaged on the preparation of A.R.P. schemes and the designs of shelters. The Civil Defence Bill, which has now passed its Committee stage in Parliament, will impose obligations for the provision of certain standards of protection and define the terms upon which grants will be made for this purpose.

*In addition the Government has issued a number of publications dealing with the technical aspects of shelter design and relevant problems.*

*In this and next week's issue Messrs. Samuely and Hamann review all the relevant official publications, explain the standards of protection laid down, and illustrate methods of providing the required protection under varying conditions.*

*The JOURNAL believes that this illustrated commentary and explanation, read in conjunction with the official publications (listed in Appendix IX Part 2—June 8) will materially help all technical advisers who are consulted on matters of A.R.P.\**

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\* Although the more important provisions of the Civil Defence Bill (reviewed in this issue) are not likely to be changed before the Bill becomes an Act, minor provisions may be so changed. In this case the Journal will issue a Supplement explaining the changes and cross-referenced so as to be read with this issue.

## INTRODUCTION

**F**OR a long time there has been considerable discussion and argument on the best method of obtaining protection against aerial bombing. One school of thought has advocated, strongly, the provision of deep shelters affording reasonably high protection against the direct hits of high explosive bombs. Another has taken the view that, as nothing which is not too costly can be guaranteed to be "bomb-proof," there is little point in doing anything. Yet another school maintains that, without giving protection against actual direct hits, the effects of an air raid can be very much reduced by fairly simple measures, such, for example, as the constructing of shelters against blast and splinters.

With the passing of the Bill such discussions will, for the present, be more or less pointless. The Government have come to the decision that "blast and splinter" protection would best suit the conditions in this country, and they have published a provisional Code for the standards to be observed and have provided for the financing of such protective measures.



There is nothing, however, to discourage the construction of shelters of higher standards than the minima specified—except the fact that grants will probably not be made for the expense of providing the extra protection. Nor is there anything to prevent the Government at any later date from varying the present standard by the issuing of a new Code.

It is not the intention of this investigation to form any argument for or against the Government's policy on this matter. The facts remain that certain standards have now been set, and that they will be of general application—or at least will become so after the passing of the Act.

The aim of this analysis is to assist the technician in his interpretation and application of the legal and technical requirements.

In many respects the regulations indicate only on very general lines what standards are to obtain; but there are hundreds of dependent problems which arise in practice for which the regulations make no specific rules. We have endeavoured as far as it has been possible to give a guide to the answers of those problems. There is a very urgent need for the acceptance of rules standardizing those matters of which the Code and other regulations do treat specifically. Three outstanding considerations call for the settling of such points without delay. They are:

(a) *Finance.*

Employers, as well as certain others who provide shelters for people, will receive, from moneys allocated by Parliament, grants proportional to the costs of the shelters, or as considered reasonable in any particular case. Lower standards than those prescribed will not be accepted; but as higher standards will not receive proportionally higher grants, it is important that the technical adviser should be familiar with the accepted standard.

[All the same, it is possible that many clients will provide the highest degree of protection which circumstances allow for people depending on their shelters, even though it may involve them in extra expenses.]

(b) *Time.*

The Bill assumes that all work on protective measures covered by it will be completed or be in hand by a fixed date. If doubts existed as to standards, much time would be lost in negotiations between expert advisers and local authorities, and difficulties on the labour market would, consequently, be considerably aggravated.

(c) *Administration.*

Standard interpretations of ordinary laws and regulations seldom evolve within a year or two after the publication of those regulations.

In the present circumstances, if (as seems probable) the construction of shelters which are to qualify for grants must be begun by September 30, there will be less than four months in which to arrive at a uniform method of approach. It is therefore very necessary that some standard methods of dealing with problems not fully covered by the A.R.P. Department's publications should be adopted as soon as possible.

F. J. S.  
C. W. H.

*A list of all publications will be given at the end of the  
Second Part of this survey (June 8). This First Part is  
divided into the following sections:*

|                                                                                               |     |
|-----------------------------------------------------------------------------------------------|-----|
| SUMMARY OF AIR RAID PRECAUTIONS ACT, 1937 .. ..                                               | 901 |
| CIVIL DEFENCE BILL .. .. .                                                                    | 902 |
| PROVISIONAL CODE FOR AIR RAID SHELTERS FOR<br>FACTORIES AND COMMERCIAL BUILDINGS (FIRST HALF) | 925 |

## AIR RAID PRECAUTIONS ACT, 1937

**T**HE provisions of the Air Raid Precautions Act, 1937 (1 & 2 Geo. 6., Ch. 6—H.M.S.O. Price 3d.), are summarized below. This Act lays down the general framework of A.R.P., imposes obligations on local authorities, and allows them to incur expenditure, buy land, etc., for A.R.P. purposes.

Section 1 (1) (2) (3).—An Act to secure that precautions shall be taken with a view to the protection of persons and property from injury or damage in the event of hostile attack from the air.

County Councils are to prepare Air Raid General Precautions schemes in collaboration with local district councils; but with the Secretary of State's approval Borough or Urban Councils may prepare such schemes for their districts.

Borough, County Borough and Urban Councils are to prepare Air Raid Fire Precautions schemes, but Rural Councils may also prepare such schemes.

Section 1 (4).—The Secretary of State is to indicate which matters are to be covered by schemes; but in special cases he may not require a scheme to be submitted relating to any particular matter.

Section 1 (5).—Local authorities may (or might be required to) submit separate schemes for different matters or for different areas.

Section 1 (6).—A council, having submitted a scheme, may arrange with another council (which is also required to have submitted a scheme) to carry out the function as an agent.

Section 1 (7).—Any scheme may make provision for certain expenditure to be dealt with as special county expenditure.

Section 2 (1).—In regard to London, the Secretary of State is to allocate matters for Air Raid General Precautions schemes to the London County Council, the Common Council of the City of London and the Metropolitan Borough Councils.

Section 2 (2).—In London the London County Council is to submit the Air Raid Fire Precautions Scheme.

Section 2 (3).—The Common Council of the City of London is to be included with the Metro-

politan Borough Councils under Section 47 of the Local Government Act, 1933, for the purpose of carrying out the functions of this Air Raid Precautions Act.

Section 3 (1).—Schemes will be approved or amended by the Secretary of State.

Section 3 (2).—Local authorities must discharge their duties under schemes.

Section 3 (3).—Schemes may be amended by subsequent schemes; but the latter must be approved as were the original schemes.

Section 4 (1).—Local authorities must co-operate; but not form joint committees or delegate functions except with approval of the Secretary of State.

Section 4 (2).—Joint committees of councils may work only under order from the Secretary of State.

Section 5.—Local authorities may purchase land by compulsion for Air Raid Precautions, under orders confirmed by the Secretary of State.

Section 6.—Local authorities are to submit information to assist the Government in preparing evacuation plans.

Section 7 (1).—Local authorities may incur expenditure under the Act for A.R.P. work, whether in connection with an air raid precautions scheme or not.

Section 7 (2).—Any such expenditure incurred between July 9, 1935, and the passing of the Act may be regarded as expenditure under the Act.

Section 7 (3).—Metropolitan Borough Councils may borrow money for A.R.P. work; but the sanction of the Ministry of Health instead of that of the London County Council must be obtained except in special cases (see the actual Air Raid Precautions Act, 1937, Section (7)).

Section 8.—The Secretary of State will make to County, County Borough or District Councils, certain grants, and also grants to the City of London and Metropolitan Borough Councils. These grants are to be governed by the conditions in the Schedule to the Act.

Section 9.—Expenses incurred by the Secretary of State, with the consent of the Treasury, for supervision, training of personnel, cost of equipment and appliances and for grants to local authorities will be paid out of money provided by Parliament.

Section 10.—Within three years the Secretary of State shall examine the financial arrangements, particularly in relation to local rates.

Section 11 (1).—By arrangement with the Treasury the Secretary of State may make regulations providing for equipment, loans, gifts,\* and for approval of local authorities expenditures.

Section 11 (2).—Any order made by the Secretary of State may be revoked by any other order made by him.

Section 11 (3).—Parliament may confirm or annul any such Order.

Section 12.—Definitions: "Approved expenditure," "Local Authority."

Section 13.—Modification of the Act so as to apply to Scotland.

Section 14.—Affirmation that the Government of Northern Ireland has power to make laws for air raid precautions.

\* See Section 61, Civil Defence Bill.

# THE CIVIL DEFENCE BILL

## Civil Defence.

A

## B I L L

... further provision for civil defence and  
... stated therewith

**B**ELOW the Civil Defence Bill (H.M.S.O. Price 1s. 6d.) is reviewed. While only part of the Civil Defence Bill may concern architects and engineers, that part (which is not likely to be changed on Report stage) is of such importance that every technical expert should read it.

To simplify this task, the authors have selected those sections and subsections that concern the technician and have reprinted them with such explanatory notes as seemed necessary.

The remaining sections and subsections are summarised.

To allow a reader to find at a glance the meaning of any section, certain words have been reproduced in bold type, although the original Bill does not show such selection of words.

The authors cannot, of course, take any responsibility for the correct interpretation of the Bill by such selected words.

### PART I

### NOTES

Section 1.—Part I of the Bill enables the functions under the Air Raid Precautions Act, 1937, and this Bill to be distributed between the several Governmental Departments.

Except in Part VII, or where any other Minister is specifically named, the words "the Minister" refer to the Secretary of State, unless, by an Order in Council, all or some of his functions have been transferred to any other Minister of the Crown, to whom the words would then apply.

### PART II: PUBLIC SHELTERS, ETC.

Designation  
of premises.

2.—(1) Where it appears to the local authority that the whole or any part of a building is or can be made suitable—

(a) for use as a public air-raid shelter; or

(b) for use, in the event of hostile attack, by the local authority in carrying out any of their civil defence functions,

the local authority may post in the building or part a notice declaring that that building or part may be required for use for public purposes of civil defence.

(2) Where the local authority post such a notice they shall notify the Minister and take such steps as appear reasonably practicable to bring the contents of the notice to the knowledge of the persons having estates or interests in the building or part of a building, and section fifteen of the Land Charges Act, 1925, (which relates to the registration of local land charges) shall apply in relation to such a notice as if the notice were a local land charge and the notice shall be registered by the proper officer as a local land charge accordingly.

(3) The local authority may at any time withdraw any such notice as aforesaid by posting a notice to that effect in the building or part of a building, and causing the registration of the notice as a local land charge to be cancelled.

(4) A building or part of a building where a notice under subsection (1) of this section has been posted and has not been withdrawn is in this Act referred to as "designated premises" and references in this Act to the designation of premises shall be construed accordingly.

(5) Notwithstanding anything in this section the local authority shall not, without the prior consent of the appropriate department, designate any premises which either—

(a) are occupied by any public utility undertakers for the purposes of their undertaking, or

(b) are situate on land over which any public utility undertakers exercise any control under any enactment or order relating to their undertaking.

Appeal from  
designation  
of  
premises.

3.

Section 3.—Where a building or part of a building which has been designated as described in section 2, is, in fact, to be used as a private shelter for the inhabitants of the building, or where it is to serve some other important public function, an appeal against the designation may be made to the Minister.

Execution of  
works.

4.—Where it appears to the local authority expedient for the purpose of making designated premises suitable or more suitable for any of the purposes mentioned in subsection (1) of section two of this Act, or of keeping them suitable for any of those purposes, that works should be executed in those premises, or in the building of which they form part, or in or on any adjacent building or land, they may, if they are unable to secure the execution of those works by agreement, themselves execute those works :

Provided that—

- (a) the local authority shall not, except with the agreement of all persons concerned, begin any such works as aforesaid until the period has expired for appealing to the Minister against the designation of the premises in question or, if an appeal is brought within that period, until the determination of that appeal ;
- (b) before entering (otherwise than with the consent of the occupier) on any premises, building or land for the purpose of executing any works, the local authority shall give to the occupier at least fourteen days' notice in writing of their intention to do so, but any such notice may be given at any time after the designation of the premises.

Designated  
premises to  
remain  
unaltered.

5.—(1) Subject to the provisions of this section, no person shall, without the consent of the local authority—

- (a) make any structural alteration in any designated premises ; or
- (b) remove or alter any works executed by, or by arrangement with, the local authority in any designated premises, any building of which designated premises form part, or any building or land adjacent to any designated premises :

Provided that if the local authority refuse their consent or do not give their consent within six weeks from the date on which application is made therefor, the applicant may appeal to a court of quarter sessions, and the court on the hearing of the appeal may authorise any alteration or removal desired by the applicant.

Subsections (2) and (3) deal with penalties for contravention of the requirements of this section.

Compensation where  
works are  
executed.

6.—(1) Where works are executed under the preceding provisions of this Part of this Act in or on any premises, building or land by a local authority, the occupier of the premises, building or land shall be entitled to recover from the local authority the damage he has sustained by reason of any interference with his use of the premises, building or land during the execution of the works.

(2) Where by reason of the execution aforesaid of any works, the usefulness of any premises, building or land is impaired, the local authority shall pay to the person who from time to time is the occupier of the premises, building or land, periodical sums, payable quarterly in arrear, calculated by reference to the diminution of the annual value of the premises, building or land, as the case may be, ascribable to the said impairment of the usefulness thereof.

Section 6 (3).—The payments (under section 3 (2)) are to cease when any premises cease to be designated and then, on request of the occupier, the local authority must restore the premises to suitable condition for the private purposes of the occupier or else make a payment equal to the value of the depreciation.



Powers of local authorities to construct underground shelters and other premises required for civil defence purposes.

7.—(1) Subject to the provisions of this section, **the local authority may enter on any land, after giving not less than twenty-eight days' notice** in writing to the occupier and every person having the fee simple or a lease of the land or any part thereof, **and there construct—**

- (a) **an underground air-raid shelter** or other underground premises **required** by the authority for use **in the event of hostile attack** in carrying out any of their civil defence functions ;
- (b) **entrances to, and shafts and other necessary works for ventilating, draining, lighting and heating the shelter or premises.**

(2) Where the local authority propose to construct the underground shelter or premises in any protected square or in any allotment, common or open space, the following provisions shall apply—

- (a) **the authority shall**, in addition to giving any notice required by the preceding subsection, **publish** by advertisement in a newspaper circulating in the area of the authority **a notice** describing the nature of their proposals and **specifying the land** to which they relate, **and naming the place where plans** illustrative of their proposals **may be inspected** at all reasonable hours by any person free of charge ;
- (b) **if, within twenty-eight days** after the publication of the notice, **any notice of objection** to the proposals **is served** on the local authority **by any person affected** thereby, **the authority shall refer** the notice of objection **to the Minister** for his consideration **and shall not proceed** with the proposals **unless the Minister**, after holding, if he thinks fit, an inquiry, **has approved them**, either with or without modification.

(3) **The local authority may**, in the exercise of their powers under this section, **construct a shelter or other premises under any highway :**

**Provided that**, in the case of a highway for the maintenance of which a highway authority is responsible, **the local authority shall not** exercise those powers without the consent of the highway authority (if it is a different authority) and shall **not be required to serve any notices on persons having an estate or interest in the subsoil of the highway.**

(4) **Any shelter or premises constructed by the local authority** under this section, together with the entrances to the shelter or premises and any shafts or other works executed in connection with the shelter or premises, **shall, on completion, vest in the authority.**

(5) **The local authority shall pay to any person having an estate or interest in any land** in which works are constructed under this section such **compensation**, if any, in respect of any damage thereby caused to him, as may be just.

(6) **The powers** conferred on local authorities by this section **shall not be exercisable** with respect to any **land occupied by public utility undertakers** for the purposes of their undertaking.

(7) In this section the expression "protected square" has the meaning assigned to it by section two of the London Squares Preservation Act, 1931, and the expressions "allotment," "common," and "open space," have the same meanings as in Part II of the Third Schedule to the Town and Country Planning Act, 1932.

See Appendix VII.

Powers of local authorities to construct underground car-parks suitable for use as air-raid shelters.

8.—(1) **A local authority** who have power under section sixty-eight of the Public Health Act, 1925, or under section twenty of the Restriction of Ribbon Development Act, 1935, to provide parking places **may**, for the purpose of **providing underground parking places** suitable also for use as air-raid shelters, **exercise the like powers** as are exercisable by local authorities under the last preceding section for the purposes therein mentioned, subject, however, to the following provisions of this section.

(2) Any such local authority as aforesaid who are not the local authority for the purposes of this Part of this Act and are not exercising functions under this Part of this Act by virtue of a delegation shall not make any proposal for the exercise of the said powers for the purpose of providing such an underground parking place as aforesaid, without the approval of the local authority for the purposes of this Part of this Act.



(3) Where a **local authority** propose to exercise the said powers for the purpose of constructing such an underground parking place, they **shall**, in addition to giving notice to the persons to whom they are required to **give notice** by subsection (1) of the last preceding section,—

(a) give notice in writing to the **Minister and the Minister of Transport**;

(b) **publish** by advertisement in a newspaper circulating in the area of the authority a notice describing **the nature of their proposals** and specifying the land to which they relate and naming the place where plans illustrative of their proposals may be inspected at all reasonable hours by any person free of charge.

(4) If, within twenty-eight days after the publication of the notice, any notice of objection to the proposals is served on the local authority by any person affected thereby, the authority shall refer the notice of objection to the Minister of Transport for his consideration, and shall not proceed with the proposals unless the Minister of Transport, after holding, if he thinks fit, an inquiry, has approved the proposals either with or without modification.

(5) **The local authority shall not**, whether or not any such objection or modification as aforesaid has been made, **proceed with any proposals** under this section **unless the Minister**, after satisfying himself that the underground parking place proposed to be provided will be suitable for use as an air-raid shelter, and after considering the needs of the locality, the situation and the capacity of the shelter and any other matters appearing to him to be relevant, **has approved the proposals**.

(6) Subsection two of the last preceding section shall not apply in any case where the powers conferred by that section are exercised by virtue of and in accordance with this section.

Subsection 7 relates to the financing of such car park shelters

Agreements under Part II between local authority and occupiers or owners of factory premises and commercial buildings.

9.—(1) **The local authority may**, if a representation is made to it by a factory inspector that air-raid shelter cannot reasonably be provided in factory premises for the persons working or living therein, **agree with the occupier** of the premises **to provide**, on such terms as to payments by the occupier to the local authority as may be specified in the agreement, **a public air-raid shelter** which will be available for use, in whole or in part, by those persons.

(2) Subsection (1) of this section shall apply in relation to commercial buildings as it applies in relation to factory premises—

(a) with the substitution for references to the occupier of references to the owner; and

(b) with the substitution for the reference to a factory inspector of a reference to a local authority for the purposes of Part III of this Act, or, if that local authority is identical with the authority providing the shelter, with the omission of the reference to the representation of a factory inspector.

See Appendix VII.

Local authorities for the purpose of Part II.

10.

Section 10.—This section defines local authorities for the purpose of Part II.

## PART III: PRIVATE SHELTERS AND TRAINING IN CERTAIN FACTORIES, MINES AND BUILDINGS

Application of Part III.

11.—**This Part of this Act, except the provisions thereof relating to the training of employed persons, shall apply only in relation to areas specified in that behalf in an order made by the Minister, and accordingly in this Part of this Act, except in the said provisions, references to factory premises, mines and commercial buildings shall be construed as references to factory premises, mines and commercial buildings (as defined for the general purposes of this Act) which are situate in such an area:**

Provided that the **Minister may by order declare that any specified factory premises shall be treated** for the purposes of this Part of this Act **as if they were included in such an area as aforesaid, and while such an order is in force they shall be so treated accordingly.**

For the definitions of factory premises, etc., see section 80.

On April 25 the Office of the Lord Privy Seal issued a provisional list of the Areas directly concerned. The list includes the more populous areas assumed to be most exposed to attack, and it was indicated that alterations to the list would be by way of additions rather than by deletions.

The list of areas is reproduced immediately below and they have been plotted on the map facing page 906.

## ENGLAND\*

LONDON  
City of London  
All Metropolitan Boroughs  
COUNTIES  
BEDFORDSHIRE  
*Municipal Borough*  
Luton  
BUCKINGHAMSHIRE  
*Municipal Borough*  
Slough  
CAMBRIDGESHIRE  
None  
CHESHIRE  
*County Boroughs*  
Birkenhead  
Stockport  
Wallasey  
*Municipal Boroughs*  
Bebington  
Crewe  
Dukinfield  
Hyde  
Sale  
Stalybridge  
*Urban Districts*  
Bredbury and Romiley  
Ellesmere Port  
Runcorn  
CORNWALL  
*Municipal Borough*  
Saltash  
*Urban District*  
Torpoint  
CUMBERLAND  
None  
DERBYSHIRE  
*County Borough*  
Derby  
*Municipal Borough*  
Chesterfield  
DEVONSHIRE  
*County Borough*  
Plymouth  
DORSETSHIRE  
None  
DURHAM  
*County Boroughs*  
Darlington  
Gateshead  
South Shields  
Sunderland  
West Hartlepool  
*Municipal Boroughs*  
Durham  
Hartlepool  
Jarrow  
Stockton-on-Tees  
*Urban Districts*  
Billingham  
Bolden  
Blaydon  
Chester-le-Street  
Consett  
Felling  
Hebburn  
Hetton  
Houghton-le-Spring  
Ryton  
Seaham  
Stanley  
Washington  
Whickham  
ELY, ISLE OF  
None  
ESSEX  
*County Boroughs*  
East Ham  
Southend-on-Sea  
West Ham  
*Municipal Boroughs*  
Barking  
Chingford  
Dagenham  
Harwich  
Ilford  
Leyton  
Romford  
Walthamstow  
Wanstead and Woodford

\* Although Berkshire is not listed it is intended at this stage that no areas in that county should be included.

*Urban Districts*  
Benfleet  
Billericay  
Brentwood  
Canvey Island  
Chigwell  
Hornchurch  
Thurrock  
Waltham Holy Cross  
GLOUCESTERSHIRE  
*County Borough*  
Bristol  
*Urban Districts*  
Kingswood  
Mangotsfield  
HEREFORDSHIRE  
None  
HERTFORDSHIRE  
*Municipal Borough*  
Watford  
*Urban Districts*  
Barnet  
Bushey  
Cheshunt  
East Barnet  
*Rural Districts*  
Barnet  
Watford  
(Parish of Aldenham only)  
HAMPSHIRE see Southampton  
HUNTINGDONSHIRE  
None  
KENT  
*Municipal Boroughs*  
Beckenham  
Bexley  
Bromley  
Chatham  
Dartford  
Dover  
Erith  
Gillingham  
Gravesend  
Margate  
Queenborough  
Ramsgate  
Rochester  
*Urban Districts*  
Broadstairs and St. Peters  
Chislehurst and Sidcup  
Crayford  
Northfleet  
Orpington  
Penge  
Sheerness  
Swanscombe  
*Rural District*  
Dartford  
LANCASHIRE  
*County Boroughs*  
Barrow-in-Furness  
Blackburn  
Bolton  
Bootle  
Burnley  
Bury  
Liverpool  
Manchester  
Oldham  
Preston  
Rochdale  
St. Helens  
Salford  
Warrington  
Wigan  
*Municipal Boroughs*  
Ashton-under-Lyne  
Chorley  
Crosby  
Eccles  
Heywood  
Leigh  
Middleton  
Mossley  
Radcliffe  
Stretford  
Swinton and Pendlebury  
Widnes  
*Urban Districts*  
Abram  
Adlington  
Ashton-in-Makerfield  
Aspull  
Atherton

Audenshaw  
Billinge and Winstanley  
Blackrod  
Brierfield  
Chadderton  
Crompton  
Denton  
Droylesden  
Failsworth  
Farnworth  
Golborne  
Haydock  
Hindley  
Horwich  
Huyton-with-Roby  
Ince-in-Makerfield  
Irlam  
Kearsley  
Lees  
Litherland  
Little Lever  
Milnrow  
Newton-in-Makerfield  
Orrell  
Prescot  
Prestwich  
Rainford  
Royton  
Standish-with-Langtree  
Tyldesley  
Urmston  
Westhoughton  
Whitefield  
Worsley  
*Rural Districts*  
Limehurst  
Whiston  
LEICESTERSHIRE  
*County Borough*  
Leicester  
LINCOLNSHIRE  
PARTS OF LINDSEY  
*County Borough*  
Grimsby  
*Municipal Boroughs*  
Cleethorpes  
Scunthorpe  
*Urban District*  
Barton-upon-Humber  
MIDDLESEX  
The whole county  
NORFOLK  
*County Boroughs*  
Great Yarmouth  
Norwich  
NORTHAMPTONSHIRE  
*County Borough*  
Northampton  
NORTHUMBERLAND  
*County Boroughs*  
Newcastle-upon-Tyne.  
Tynemouth  
*Municipal Boroughs*  
Blyth  
Wallsend  
Gosforth  
Longbenton  
Newburn  
Seaton Valley  
Whitley and Monkseaton  
NOTTINGHAMSHIRE  
*County Borough*  
Nottingham  
*Urban District*  
Arnold  
Beeston and Stapleford  
Carlton  
Hucknall  
West Bridgford  
OXFORDSHIRE  
None  
PETERBOROUGH, SOKE OF  
None  
RUTLANDSHIRE  
None  
SHROPSHIRE  
None  
SOMERSETSHIRE  
*Urban District*  
Portsmouth  
*County Boroughs*  
Portsmouth  
Southampton

*Municipal Borough*  
Gosport  
*Urban Districts*  
Fareham  
Havant and Waterloo  
STAFFORDSHIRE  
*County Boroughs*  
Smethick  
Stoke-on-Trent  
Walsall  
West Bromwich  
Wolverhampton  
*Municipal Boroughs*  
Bilston  
Newcastle-under-Lyme  
Rowley Regis  
Tipton  
Wednesbury  
*Urban Districts*  
Aldridge  
Amblecote  
Brierley Hill  
Coseley  
Darlaston  
Sedgley  
Tettenhall  
Wednesfield  
Willenhall  
SUFFOLK  
*County Borough*  
Ipswich  
SURREY  
*County Borough*  
Croydon  
*Municipal Boroughs*  
Barnes  
Beddington and Wallington  
Epsom and Ewell  
Kingston-on-Thames  
Malden and Coombe  
Mitcham  
Richmond  
Surbiton  
Sutton and Cheam  
Wimbledon  
*Urban Districts*  
Banstead  
Carshalton  
Caterham and Warlingham  
Coulsdon and Purley  
Esher  
Merton and Morden  
Walton and Weybridge  
SUSSEX  
None  
WARWICKSHIRE  
*County Boroughs*  
Birmingham  
Coventry  
*Municipal Boroughs*  
Nuneaton  
Rugby  
Sutton Coldfield  
*Urban District*  
Bedworth  
WESTMORLAND  
None  
WIGHT, ISLE OF  
None  
WILTSHIRE  
None  
WORCESTERSHIRE  
*County Borough*  
Dudley  
*Municipal Boroughs*  
Halesowen  
Oldbury  
Stourbridge  
YORKSHIRE, EAST RIDING  
*County Borough*  
Kingston-upon-Hull  
*Municipal Borough*  
Hedon  
*Urban District*  
Haltemprice  
YORKSHIRE, NORTH RIDING  
*County Boroughs*  
Middlesbrough  
York  
*Municipal Boroughs*  
Redcar  
Thornaby-on-Tees.

The fold-in map opposite shows the Areas provisionally specified under Section 11 of the Civil Defence Bill.

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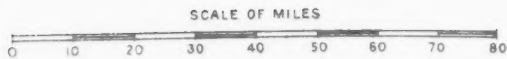
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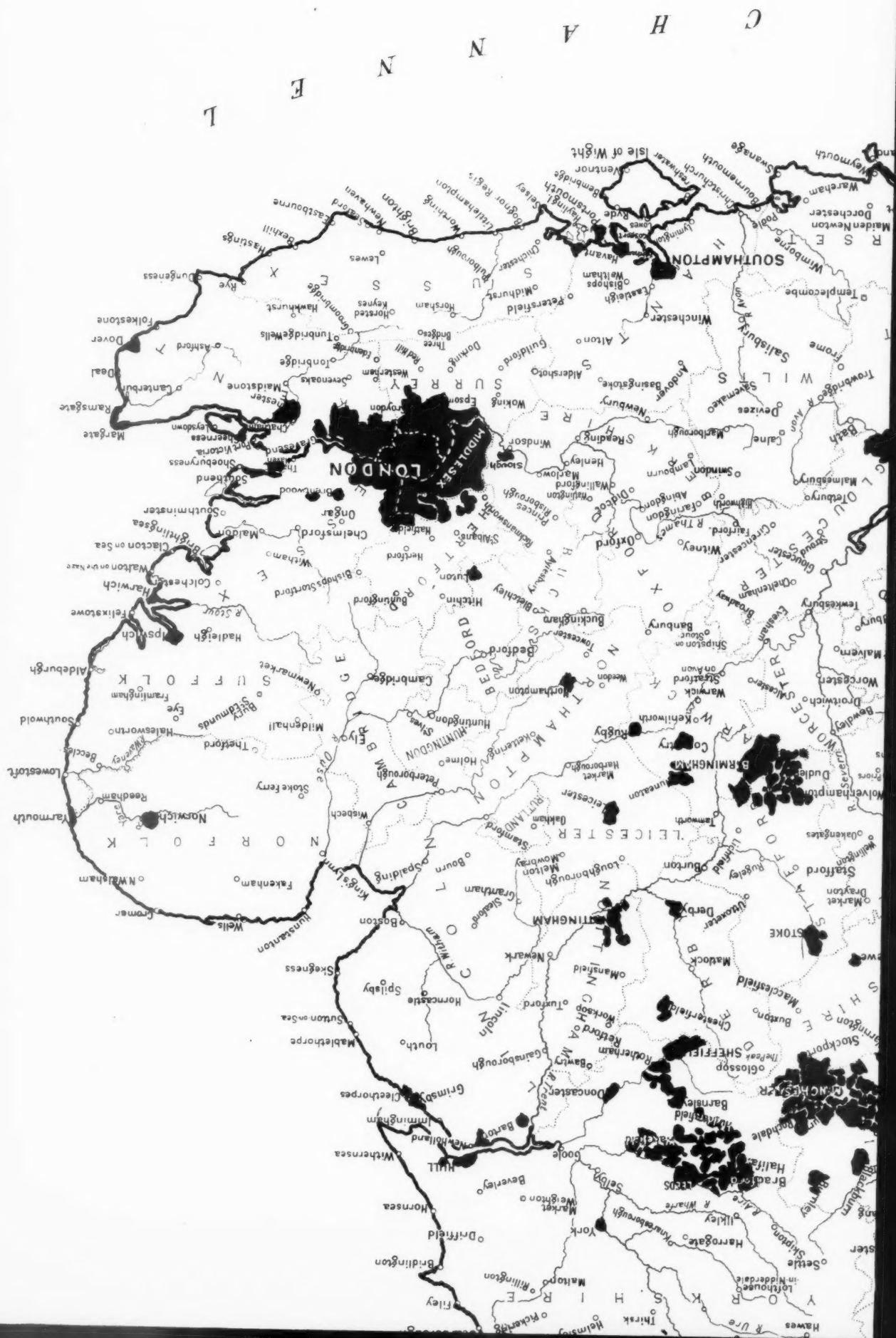
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|------------------------------------|-------------------------------------|--------------------------------------|----------------------|
| <i>Urban District</i><br>Eston     | Leeds                               | <i>Urban Districts</i><br>Castleford | Mirfield             |
| YORKSHIRE, WEST RIDING             | Rotherham                           | Conisbrough                          | Normanton            |
| <i>County Boroughs</i><br>Barnsley | Sheffield                           | Dearne                               | Queensbury and Shelf |
| Bradford                           | Wakefield                           | Elland                               | Rawmarsh             |
| Dewsbury                           | <i>Municipal Boroughs</i><br>Batley | Featherstone                         | Rothwell             |
| Doncaster                          | Brighouse                           | Heckmondwike                         | Shipley              |
| Halifax                            | Morley                              | Horbury                              | Spennorth            |
| Huddersfield                       | Ossett                              | Horsforth                            | Stanley              |
|                                    | Pontefract                          | Hoyland Nether                       | Swinton              |
|                                    | Pudsey                              | Mexborough                           | Wath-upon-Deane      |
|                                    |                                     |                                      | Wombwell             |
|                                    |                                     |                                      | Worsborough          |

## WALES

|      |                 |                                   |                                    |                                  |
|------|-----------------|-----------------------------------|------------------------------------|----------------------------------|
| None | ANGLESEY        | DENBIGHSHIRE                      | <i>Municipal Boroughs</i><br>Neath | MERIONETH                        |
| None | BRECKNOCK       | None                              | Port Talbot                        | None                             |
| None | CAERNARVONSHIRE | FLINTSHIRE                        |                                    | MONTGOMERY                       |
| None | CARDIGANSHIRE   | None                              |                                    | None                             |
| None | CARMARTHENSHIRE | GLAMORGANSHIRE                    | <i>Urban Districts</i><br>Barry    | MONMOUTHSHIRE                    |
| None |                 | <i>County Boroughs</i><br>Cardiff | Bridgend                           | <i>County Borough</i><br>Newport |
| None |                 | Swansea                           | Penarth                            | PEMBROKESHIRE                    |
|      |                 |                                   |                                    | None                             |
|      |                 |                                   |                                    | RADNOR                           |
|      |                 |                                   |                                    | None                             |

## SCOTLAND

|        |                  |                                         |                                 |                                    |
|--------|------------------|-----------------------------------------|---------------------------------|------------------------------------|
| None   | ABERDEENSHIRE    | <i>Large Burghs</i><br>Clydebank        | <i>Large Burghs</i><br>Airdrie  | <i>Small Burghs</i><br>Gourock     |
| City   | ANGUS            | Dumbarton                               | Coatbridge                      | Renfrew                            |
| Dundee |                  | <i>Districts</i><br>Old Kilpatrick      | Hamilton                        | ROSS AND CROMARTY                  |
| None   | ARGYLLSHIRE      | FIFE                                    | Motherwell and Wishaw           | None                               |
| None   | AYRSHIRE         | <i>Large Burghs</i><br>Dunfermline      | Rutherglen                      | ROXBURGHSHIRE                      |
| None   | BANFFSHIRE       | Kirkcaldy                               | MIDLOTHIAN                      | None                               |
| None   | BERWICKSHIRE     | <i>Small Burghs</i><br>Burntisland      | Edinburgh                       | SELKIRKSHIRE                       |
| None   |                  | Inverkeithing                           | None                            | None                               |
| None   | BUTESHIRE        | Kinghorn                                | MORAYSHIRE                      | STIRLINGSHIRE                      |
| None   | CAITHNESS        | <i>District</i><br>Dunfermline          | None                            | <i>Large Burghs</i><br>Falkirk     |
| None   |                  | INVERNESS-SHIRE                         | None                            | <i>Small Burghs</i><br>Grangemouth |
| None   | CLACKMANNANSHIRE | None                                    | None                            | SUTHERLAND                         |
| None   | DUMFRIESSHIRE    | KINCARDINESHIRE                         | None                            | None                               |
| None   | DUNBARTONSHIRE   | None                                    | None                            | WEST Lothian                       |
|        |                  | KINROSS-SHIRE AND<br>KIRKCUDBRIGHTSHIRE | None                            | <i>Small Burghs</i><br>Bo'ness     |
|        |                  | LANARKSHIRE                             | None                            | Queensferry                        |
|        |                  | City<br>Glasgow                         | RENFREWSHIRE                    | WIGTOWNSHIRE                       |
|        |                  |                                         | <i>Large Burghs</i><br>Greenock | None                               |
|        |                  |                                         | Paisley                         | ZETLAND                            |
|        |                  |                                         | Port-Glasgow                    | None                               |

Code for  
occupiers of  
factories,  
etc.

12.—(1) For the guidance of occupiers and owners of factory premises, factories, mines and commercial buildings, and other persons concerned in providing air-raid shelter, the Minister shall issue a code describing different types of shelter appropriate for different classes of cases, or, if such a code has been issued before the commencement of this Act, he may by order approve the code for the purposes of this Act; and he may from time to time by order revise any such code by revoking, varying or adding to its provisions.

(2) In this Part of this Act the expression "shelter of an approved type" means shelter of a type described in such a code.

Duties of  
occupiers  
and owners  
of factory  
premises,  
mines and  
commercial  
buildings to  
make  
reports.

13.—(1) It shall be the duty of every person who is the occupier of any factory premises, the owner of any mine or the owner of any commercial building—

- not later than three months from the appropriate date to make a report in writing, in the case of factory premises to the factory inspector for the district, in the case of a mine to the mines inspector for the district, and in the case of a commercial building, to the local authority, stating what measures he has taken or is taking or proposing to take to provide air-raid shelter for the persons working or living in the factory premises, working in or about the mine, or working or living in the commercial building, as the case may be;
- on the completion of any works mentioned in any such report which have not been begun or are still incomplete at the date of the report, to report their completion in writing to the said inspector or local authority, as the case may be.

The draft of a provisional code for shelters in factories and commercial buildings was published by the office of the Lord Privy Seal during April, 1939, and its requirements are analysed and amplified on page 925.

"Factories," "commercial" buildings and "mines," are defined in section 80 of the Act, to refer to buildings only in which more than 50 people are employed. While only the owners of such buildings are under an obligation to provide shelter for employees, it is understood, that where the owner of a building where less than 50 people are employed wishes to provide shelter for these, a grant would be available in the same way as for those buildings to which the code refers directly.

[Map to face page 906]

Section 13 (2).—Relates to penalties for contravention of the requirements of this section.

Section 13 (3).—The appropriate date as defined by subsection (3) of this section is to be taken as the latest of the dates of—

- (a) the first issue or approval of a code as required by section 12 (1);
- (b) the making of an order by which a particular area is brought under the provisions of this Part (Part III) if the area has not already been included in the list (section 11);
- (c) the satisfying of the conditions which define "factory premises," "mine" or "commercial building" for the purposes of the Act (section 80).

Power of occupier or owner to execute works.

14.—(1) Subject to the provisions of this Part of this Act as to appeals and notices, **the occupier of any factory premises, the owner of any mine and the owner of any commercial building may execute any works for the purpose of providing shelter** of an approved type in the premises, or, in the case of a mine or commercial building, in any part of the mine or building or on any land adjacent to the mine or building to which the estate or interest of the owner extends.

Approved type would be a type, which designed by an expert, is approved by the particular authority (see section 12).

Subsections (2) and (3) relate to the serving of notices on the owners of factory buildings and on the occupants of commercial buildings. Subsection (4) refers to notices to anybody to whom rent is paid directly or indirectly by either—

- (a) occupiers of factory buildings;
- (b) owners of commercial buildings.

The intention of this subsection is that for the purpose of providing shelter under this Act the owner or occupier shall have full power to enter premises which are, for example, let to tenants, in spite of any agreement between an owner and a tenant for the full and uninterrupted enjoyment of the premises by the tenant.

(5) The rights conferred by this section on the occupier of factory premises, the owner of a mine and the owner of a commercial building shall be exercisable by him notwithstanding any limitation on his interest in the premises, mine or building or any agreement or restrictive covenant to the contrary, and notwithstanding, in the case of the owner of a commercial building, that he is not in occupation of the part of the building, or the land affected, and the person who exercises any such right shall not be liable to pay damages for anything done by him which is reasonably necessary for the due exercise of the right.

Power of factory inspector, mines inspector or local authority to require provision of air-raid shelter.

15.—(1) **A factory inspector may serve on the occupier of factory premises, a mines inspector may serve on the owner of a mine, and the local authority may serve on the owner of a commercial building** (whether or not any report has been made under the preceding provisions of this Part of this Act) **a notice in writing requiring him to provide air-raid shelter** of such approved type as may be specified in the notice for the persons working or living in the factory premises, working in or about the mine, or working or living in the commercial building, as the case may be.

(2) Any such notice shall state—

- (a) that the **shelter is to be provided within such time as may be specified in the notice** or such longer time as the Minister may allow;
- (b) that **that time will begin to run twenty-eight days after the service of the notice**, or, if an appeal is brought against the notice, from the date of the determination of the appeal.

(3) **An occupier or owner on whom such a notice has been served shall not exercise any power to execute works conferred by the last preceding section except for the purpose of complying with the said requirements.**

It will be the duty of the owner, not of the factory inspector, mines inspector or local authority to provide the design for his shelter, though they have to approve it.

Subsections (4), (5), (6) and (7) refer to penalties for contravention of the requirements of this section and to the serving of notices on the occupants of commercial buildings and factories. Subsection (8) refers to the legal position, where shelters are provided by agreement with local authorities under section 9, Part II.

## Appeals.

16.—(1) Where a notice is served under subsection (2) of section fourteen or subsection (1) of section fifteen of this Act, **any person who was served thereunder with the notice or is entitled to any interest which may, under the provisions of this Part of this Act relating to factory premises occupied under short leases, become the subject of a charge in respect of the expenses of the occupier of the premises in providing the shelter to which the notice relates or is under the provisions of this Part of this Act relating to increases of rent in the case of certain commercial buildings, liable to an increase of rent in respect of the expenses of the owner of the building in providing the shelter to which the notice relates, may, within the period specified in subsection (4) of this section, appeal to the Minister on the ground that—**

- (a) **the shelter is not of the approved type** most appropriate to the circumstances of the case ; or
- (b) **it is not reasonable to require the provision of any air-raid shelter** in the case of the premises, mine or building.

Subsections (2), (3), and (4) refer to legal proceedings and to time limits.

Provisions as to factory premises occupied under short leases.

## 17.

This section deals solely with legal arrangements.

Special provisions as to commercial buildings when owner does not occupy the whole building.

18.—(1) **Where works are, by virtue of this Part of this Act, executed by the owner of a commercial building in any part thereof of which he is not the occupier, the occupier of that part of the building shall be entitled to recover from the owner compensation for any damage he has sustained by reason of any interference with his use of that part of the building during the execution of the works.**

Any such compensation shall be charged on the estate or interest of the owner in the building, and any such charge may be registered under section ten of the Land Charges Act, 1925, as a land charge of Class A.

(2) **Where usefulness of any part of a commercial building is impaired by reason of the execution therein of any works by virtue of this Part of this Act by the owner of the building, then, unless it is otherwise agreed in connection with, or after, the provision of the shelter, the rent payable under every lease derived from the estate or interest of the owner, being a lease in existence at the date of the completion of the works and comprising the part of the building the usefulness of which is so impaired, shall be decreased to the extent and for the period specified in the subsequent provisions of this section.**

(3) **The said decrease shall be at an annual rate equal to the diminution of the annual value of the part of the building ascribable to the impairment, ascertained as at the date of the completion of the works.**

(4) **Where a notice has been served under the preceding provisions of this Part of this Act by or on the owner of a commercial building who is not the occupier of the whole of the building, and the owner has incurred expenses in providing shelter of the type specified in the notice, then, unless the notice has been cancelled on appeal, the rent payable under every lease derived from his estate or interest (being a lease in existence at the date of the completion of the works) shall, unless it is otherwise agreed in connection with, or after, the provision of the shelter, be increased to the extent and for the period specified in the subsequent provisions of this section :**

**Provided that no increase shall be payable by any person unless the owner has served the notice, or, as the case may be, a copy thereof, on all the persons on whom he is required to serve it by the preceding provisions of this Part of this Act within the time limited by those provisions.**

(5) **The said increase shall be at the annual rate of the total of the two following amounts, that is to say :—**

- (a) **one-tenth of the expenses of the owner under the notice ;**
- (b) **any diminution of the annual value of any part of the building ascribable to an impairment of the usefulness thereof by reason of the execution of the works ascertained as at the date of the completion of the works :**

**Provided that in the case of a lease of part of a commercial building, the increase shall be calculated by reference not to**

This section, read together with section 21 referring to grants lays down the principle of responsibility for air-raid shelters where divided occupancy of a building should leave any doubt.

Everybody occupying a part of a commercial building, factory, etc., is responsible for his own share of the shelter, but it is to be financed by the owner in the case of a commercial building tenants pay their share back in the form of a 10 years increase in rent. Everybody, owner and tenant, has to approach individually the Treasury to receive the grant referring to their share of expenses.

The tenants have to share all costs in proportion to their rents, and not to the number of people concerned.

An exception to this principle is not visualized, though the requirement may produce hardship in some cases.

the whole of the said total but to an amount bearing thereto the same proportion as the annual value of the part of the building at the date of the completion of the works bears to the annual value of the whole building at that date.

(6) The said increase shall operate in relation to a lease notwithstanding that the rent payable thereunder is decreased under the provisions of subsection (2) of this section, and any such increase and any such decrease shall be set off against each other accordingly.

(7) The rent on which the said increase operates is all rent payable under the lease in question in respect of any rent period beginning after the date of the completion of the works:

Provided that **no increase shall operate in respect of more than ten years.**

In this subsection the expression "rent period" means the quarter or other period in respect of which an instalment of rent becomes payable under the lease in question.

(8) In this section the expression "**expenses**" in relation to a notice **means the expenses reasonably incurred by the owner in providing shelter** of the type specified in the notice **together with—**

(a) the amount of any compensation properly paid by the owner under subsection (1) of this section; and

(b) **where the owner is the occupier of any part of the building in which works were executed for the purpose of providing shelter of the type specified in the notice, or of which the usefulness was impaired by reason of the execution of the works, the amount of compensation which he would have been entitled to recover under that subsection from the owner of the building if he himself had not been the owner thereof, and the works had been done by the owner by virtue of the provisions of this Part of this Act.**

(10) A surety for the payment of any rent which is increased under this section shall not be discharged by reason of the increase but shall not be liable in respect of the increase.

(11) **Where an owner claims or could have claimed an increase of rent under this section in respect of any expenses, he shall not be entitled to claim those expenses or any part thereof under any term of a lease requiring the tenant to pay outgoings or any similar term.**

(12) Subsections (4), (5), (7), (10) and (11) of this section shall apply in relation to any sums for which the owner of a commercial building becomes liable to a local authority (for the purposes of Part II of this Act) under an agreement for the provision of a public air-raid shelter.

Subsection (9) relates to the cancelling of the increase of the rent of lessees when faulty notices have been served.

That is to say, he cannot increase charges for current expenses such as those for gas, electricity and other services.

Contributions in respect of works commenced before the passing of this Act.

**19.—(1) Where any person having any estate or interest in factory premises or a commercial building or any part thereof has, before the passing of this Act, commenced works for the purpose of providing air-raid shelter of an approved type for all or any of the persons working or living in the premises or building, he may make a claim to the tribunal by which claims for compensation and increases and decreases of rent are determined under this Act for the payment of contributions by all or any of the persons hereinafter mentioned towards the expenses incurred in providing the shelter, and the said tribunal may order the payment of such contributions by such of the said persons as it considers just.**

(2) The persons liable to make contributions under the preceding subsection are persons having an estate in fee simple or a leasehold interest in the factory premises or commercial building, or any part thereof, being an estate or interest in existence at the passing of this Act or at the date of the completion of the works, whichever is the later, and not being an estate or interest in reversion expectant on a lease the unexpired term of which is ten years or more.

(3) The said tribunal in determining a claim under this section—

(a) may set aside or vary the terms of any agreement entered into before the passing of this Act to such extent as may be necessary to give effect to his determination;

(b) may order that the contributions (if any) shall take the form of increases or decreases of rent, or of lump sum

This section gives owners, who have provided shelters before the passing of the Act, the same legal status, as those who will provide shelters afterwards.



or periodical payments, and, if they take the form of payments, may order that they shall be charged on the interests of the persons liable therefor.

(4) In this section, references to the expenses incurred by any person in providing air-raid shelter shall include references to—

- (a) any sum which he is liable to pay as compensation for interference with the use of any part of the factory premises or commercial building during the execution of the works, or for the impairment of the value of any such part by reason of the execution of the works ;
- (b) if the works are executed in a part of the premises or building occupied by him or impair the value of a part in which he has an estate or interest, such sum as may be just in respect of the interference with the use of that part or, as the case may be, the impairment of its value.

(5) The provisions of this Act relating to the determination of claims for compensation and increases and decreases of rent shall apply in relation to the determination of claims for contributions under this section.

Saving for rights of occupier or owner existing apart from this Part.

**20. Nothing in this Part of this Act shall be construed as preventing the occupier of any factory premises, the owner of any mine or the owner of any commercial building from doing anything with a view to providing air-raid shelter which he would have been entitled to do if this Part of this Act had not been enacted, unless the doing thereof is inconsistent with compliance with the requirements of a notice duly served on him under this Part of this Act.**

Exchequer grants in respect of provision of air-raid shelter in factory premises, mines, commercial buildings, &c.

**21.—(1) Subject to the provisions of this section, there shall be paid out of moneys provided by Parliament to every occupier of factory premises and to every owner of a mine or commercial building (not being a commercial building of which no part is occupied by the owner) who provides air-raid shelter of an approved type for the persons working or living in the factory premises, working in or about the mine, or working or living in the commercial building, as the case may be, a grant equal to the appropriate proportion of so much of the expenses of a capital nature incurred by him in providing the shelter as the Minister considers reasonable :**

Provided that in the case of a commercial building, part only of which is occupied by the owner thereof, the grant shall be calculated by reference not to the whole of the said expenses but to an amount bearing thereto the same proportion as the annual value of the part of the building occupied by him at the date of the completion of the shelter bears to the annual value of the whole building at that date.

(2) Subject to the provisions of this section there shall be paid out of moneys provided by Parliament to every other person who incurs expenses of a capital nature in providing or securing the provision of air-raid shelter of an approved type for persons employed by him (otherwise than in a building in connection with which a grant is payable under subsection (1) of this section or a building wholly or mainly occupied as a school, college, hotel, restaurant, club, place of public entertainment or amusement, hospital or nursing home) a grant equal to the appropriate proportion of so much of those expenses as the Minister considers reasonable :

Provided that nothing in this subsection shall apply to any public utility undertakers.

(3) In this section the expression " the appropriate proportion " means an amount in the pound equal to the standard rate of income tax for the year 1939-40.

(4) No grant shall be paid under this section in respect of expenses incurred in providing or securing the provision of air-raid shelter unless either—

- (a) the shelter has been provided before the end of September, nineteen hundred and thirty-nine ;

For the financial arrangements in regard to tenants in commercial buildings, see section 18.

Thus a grant for a shelter will be paid only if that shelter will be completed by a certain date, given here as 30 September, 1939, or if the Minister is satisfied that it will be completed in a reasonable time after that date.

Further, it is indicated that, in general, grants will be made for expenses for shelters only up to a certain standard to be fixed by the Minister and the Treasury, but

(b) **work on the shelter is then in progress**, or preparatory measures are then being taken and in each case the Minister is satisfied that the shelter will be provided within a reasonable time thereafter;

**and no expenses shall be deemed for the purposes of this section to be reasonable in so far as they exceed such standard as may be prescribed by regulations of the Minister made with the consent of the Treasury, unless they were incurred in circumstances so prescribed.**

(5) **This section applies in relation to shelter provided before, as well as in relation to shelter provided after, the passing of this Act**, and, in relation to shelter provided before the issue or approval of such a code as is mentioned in the preceding provisions of this Part of this Act, the reference to shelter of an approved type shall be construed by reference to the first such code.

presumably the standard is that specified in the codes.

There is nothing precluding the building of shelters which, according to present knowledge, would be to a certain degree bomb proof; but as the Provisional Code\* can be taken to represent the standard which the Government at present consider reasonable, it is clear that no help from Government funds would be available for the excess costs.

There is, of course, nothing in the Bill which prevents the Minister altering that standard at any time, and it has been shown above that section 12 makes adequate provision for such an alteration.

A shelter provided before the passing of the Act would have to be also of "approved type" (see section 12), in order to be accepted.

\* Page 925.

Training of employees. 22.

Section 22.—Treats of the training of personnel in factory premises, mines and commercial buildings to which the Act applies. Reports are to be made by persons concerned, describing their arrangements for the training of persons on the premises in first aid, fire-fighting, etc. Penalties for neglect of submitting a report are set out.

Saving for certain authorities.

23. The provisions of **this Part** of this Act requiring owners and occupiers to make reports and authorising inspectors and local authorities to serve notices **shall not require the making of reports by, or authorise the service of any notice on, any local authority or any police authority** as defined in the Police Pensions Act, 1921.

Local authority for purposes of Part III.

24. Subject to the special provisions of this Act with respect to the administrative county of London, in **this Part** of this Act the expression "**local authority**" means the council of a county borough or county district:

See also section 31 for L.C.C. areas.

Provided that, in the last preceding section, it includes, subject as aforesaid, any local authority within the meaning of the Act of 1937.

## PART IV: OTHER PROVISIONS AS TO SHELTERS

Erection of shelters provided by the Crown.

25.—(1) **Where the occupier of any premises has been provided on behalf of His Majesty with materials for an air-raid shelter to be erected on the premises, the local authority shall give him advice as to the position in which the shelter should be erected:**

**Provided that, where the materials are sold to the occupier, the local authority shall not be under any duty to give such advice until requested by the occupier.**

(2) **Any occupier to whom advice has been given as aforesaid may erect the shelter in accordance therewith, and may for that purpose break up the surface of any land in his occupation, whether paved or not, but shall take due care not to damage any drains, sewers, pipes, cables or other works; and the right conferred by this subsection on any occupier may be exercised notwithstanding any agreement or restrictive covenant to the contrary, and notwithstanding any limitation on his interest in the premises, and he shall not be liable to pay damages in respect of any act which is reasonably necessary for the due exercise of the right**

Thus, for example, in spite of a tenant's being prevented by any contract with the owner or landlord from making any alterations to the premises, he may make such alterations for the accommodating of a shelter. He will be liable for damages only if the alterations are done carelessly and if as a result injury has been done to drains, cables, etc.

conferred on him, or, if he has exercised due care, for any damage done by him to drains, sewers, pipes, cables or other works.

(3) **The local authority shall in giving any advice under this section exercise such care as is reasonable in the circumstances of the case, but unless they fail to exercise such care, they shall not be under any liability in respect of any damage caused by the erection of a shelter in accordance with advice given by them.**

(4) **Where any such materials for an air-raid shelter have been provided on behalf of His Majesty without charge, the local authority may, with the consent of the occupier of the premises, themselves erect the shelter, and the provisions of subsection (2) of this section shall apply in relation to the local authority as they apply in relation to an occupier erecting a shelter in accordance with advice given by the local authority.**

(5) **For the purposes of this Part of this Act references to the erection of an air-raid shelter include references to the affixing of the shelter to, or the embedding of the shelter in, any part of the premises and the carrying out of any other works necessary for the proper erection of the shelter.**

(6) Public utility undertakers who carry on a gas or electricity undertaking shall not be liable to pay compensation or damages for or in respect of any loss of life or injury or damage to persons or property resulting from damage done by any occupier to any pipe, cable, or other work in the exercise of the powers conferred by subsection (2) of this section.

(7) This section shall be deemed to have had effect as from the commencement of the Act of 1937.

Affixing of  
appliances  
provided by  
the Crown  
for strength-  
ening  
basements.

**26.—(1) Where the occupier of any basement has been provided free of charge on behalf of His Majesty with appliances for strengthening it with a view to its use as an air-raid shelter, then, unless the occupier of the basement refuses his consent, it shall be the duty of the local authority,**

**(a) to affix these appliances, and**

**(b) to take such steps as appear desirable in order to provide additional exits from the basement or in order to enable additional exits therefrom to be readily provided ;**

and for any of the purposes aforesaid they shall have power to execute such works as may be necessary in the basement or elsewhere in the building, **including works in any party wall, and for the purpose of providing additional exits or enabling additional exits to be readily provided they shall also have power to execute such works as may be necessary in or under any part of the highway adjacent to the building, and in or under any land occupied or used in connection with the building, or in connection with the building and other buildings ; and**

(2) This section shall be deemed to have had effect as from the commencement of the Act of 1937.

Restriction  
of removal  
of shelters  
and appli-  
ances.

**27.—(1) Any materials for an air-raid shelter or appliances for strengthening a basement provided free of charge on behalf of His Majesty and with the consent of the recipients shall not be removed from the premises for which they were provided without the consent in writing of the local authority.**

**(2) Any air-raid shelter erected or appliances affixed by the local authority under the preceding provisions of this Part of this Act shall not be removed from its position without the consent in writing of the local authority.**

(3) The consent of the local authority under this section may be given absolutely or subject to conditions.

Subsection (4) refers to penalties for contravention of the requirements of this section.

Loans by  
local autho-  
rities to  
owners of  
dwelling-  
houses.

**28.—(1) The local authority may advance money to the owner of any premises comprising a dwelling-house in an area specified by the Minister in an order made under Part III of this Act (not being premises the occupier of which has been provided free of charge, on behalf of His Majesty, with materials for an air-raid shelter) for the purpose of enabling the owner to provide in the premises an air-raid shelter of a permanent character.**

**(2) Every such advance shall be repaid with interest within such period not exceeding ten years from the date of the advance as may be agreed, and the rate of interest shall be such a rate as**

may be agreed, not being a rate less than one-quarter per cent. in excess of the rate of interest which, one month before the date on which the terms of the advance are settled, was the rate fixed by the Treasury under section one of the Public Works Loans Act, 1897, in respect of loans to local authorities advanced out of the Local Loans Fund for the purposes of Part V of the Housing Act, 1936.

(3) Any amount due to a local authority by way of repayment of an advance made by them under this section may be recovered summarily as a civil debt, and shall be a charge on the premises in respect of which the advance was made, and the local authority shall, for the purpose of enforcing any such charge, have the same powers and remedies under the Law of Property Act, 1935, and otherwise as they would have if they were mortgagees by deed having powers of sale and lease and of appointing a receiver.

(4) The Public Works Loans Commissioners may, if they think fit, make loans in the manner provided by the Public Works Loans Act, 1875, to any local authority for the purpose of enabling the authority to make advances under this section, and the enactments relating to loans made by the said Commissioners shall apply (so far as applicable) to loans made by virtue of this subsection as they apply to loans made under section nine of the said Act.

(5) In this section the expression "owner" in relation to any premises, means the person in whom the fee simple is vested, and includes also a lessee of the premises under a lease the unexpired term of which exceeds three years.

Power to make regulations as to construction, alteration or extension of buildings.

29.—(1) The Minister may, after consultation with such persons having professional or other special qualifications as he thinks fit, make regulations, imposing, in relation to buildings of such classes as may be specified in the regulations—

- (a) such requirements as to materials and construction as he considers necessary for the purpose of rendering the buildings less vulnerable to air-raids;
- (b) such requirements as he considers necessary as to the provision of air-raid shelter for the persons using or resorting to the buildings.

(2) Regulations made under this section shall apply to buildings erected after the coming into operation of the regulations and, to such extent as may be specified therein, to buildings in which structural alterations are made, or which are extended, after that date:

Provided that no regulations shall apply to any building on the ground that it is erected, altered or extended after the said date, if plans for the erection, alteration or extension in question were passed by the local authority under the Public Health Act, 1936, or any corresponding enactment in any local Act, before that date.

(3) Regulations made under this section may apply generally or in such areas as may be specified in the regulations, and different requirements may be prescribed for different areas and different classes of buildings.

(4) It shall be the duty of the local authority to enforce regulations made under this section, and for that purpose—

- (a) sections sixty-four to sixty-seven of the Public Health Act, 1936, shall apply to such regulations so far as they relate to areas where building byelaws are in force, as if the regulations were building byelaws and as if the references in the said section sixty-seven to the Minister of Health were references to the Ministers;
- (b) the regulations may, so far as they relate to areas in which a local Act dealing with the construction of buildings is in force, incorporate any of the provisions of any such Act with such modifications as may be necessary;
- (c) the regulations may include provisions as to the giving of notices and the deposit of plans, sections, specifications and written particulars, and the inspection of work, and the taking of samples of materials to be used in the construction of buildings or in the execution of other works;
- (d) the regulations may provide for imposing on persons offending against the regulations fines, recoverable on summary conviction, not exceeding twenty pounds and in the case of a

This section is of particular importance to architects and engineers for it may involve not only additional sets of conditions which will have to be satisfied in the design of new buildings, but also additional conditions to be satisfied in alterations to and extensions of existing structures. No draft regulations to which this section refers have yet been published (as has the code under section 12), but such regulations, for example, may well discourage the use of inadequately secured parapets and ornaments on a building and will require shelter accommodation of not less a standard than the code for basement shelters requires. Provision against the action of incendiary bombs will also be requested. For extensions of existing buildings, other considerations than those of purely structural significance will be involved.

Further, as indicated, see subsection (6), the requirements of any regulations made under this section will over-ride any conflicting requirements of local bye-laws or building codes, and care will have to be exercised to ensure that any construction is in accordance with whichever requirement is applicable. With the consent of the Minister, a local authority may waive certain requirements of the regulations if they should be unreasonable in any particular case.



continuing offence a further fine not exceeding five pounds for each day during which the offence continues after conviction therefor.

(5) **Where the local authority consider that the operation of any regulation under this section in force in their area would be unreasonable in relation to any particular case, they may, with the consent of the Minister, relax the requirements of the regulation or dispense with compliance therewith.**

(6) **Any building byelaws, or any provisions of any such local Act as aforesaid, which are inconsistent with any regulations made under this section shall, while the regulations are in force, be void to the extent of the inconsistency.**

(7) In this section the expression "building byelaws" has the meaning assigned to it by section three hundred and forty-three of the Public Health Act, 1936, and subsection (2) of section ninety of that Act (which relates to the question what constitutes the erection of a building) shall apply for the purposes of this section as it applies for the purposes of Part II of that Act.

(8) This section shall have effect in relation to any electricity generating station as if the references therein to the Minister were references to the Electricity Commissioners, acting with the concurrence of the Minister.

Increase of housing subsidy as respects certain flats.

**30.—(1) In the case of flats to which this section applies the annual contribution payable under section one of the Housing (Financial Provisions) Act, 1938, by the Minister of Health shall be increased by two pounds in respect of each flat, and the annual contribution payable by the local authority under section six of that Act shall be increased accordingly.**

(2) This section applies to flats provided in blocks of flats within the meaning of the Housing (Financial Provisions) Act, 1938, in which air-raid shelter—

- (a) is provided in order to comply with regulations made under the last preceding section; or
- (b) is provided (whether before or after the commencement of this Act) with the approval of the Minister of Health.

In such flats shelter accommodation will have to be provided, and such other amenities as a new code may request. What conditions should be imposed in the absence of a code are not specified.

Provisions as to local authorities for purposes of Part IV.

**31.—(1) Subject to the special provisions of this Act with respect to the administrative county of London, in this Part of this Act the expression "local authority" means the council of a county borough or county district.**

(2) The council of any county may reimburse to the council of any county district within that county the whole or any part of any expenses incurred by them under the first three sections of this Part of this Act.

## PART V: PUBLIC UTILITY UNDERTAKINGS

Duty of public utility undertakers to make reports.

**32.—(1) It shall be the duty of all public utility undertakers, not later than three months from the passing of this Act, to make a report in writing to the appropriate department stating what measures they have taken or are taking or proposing to take to secure that all persons employed by them are trained as respects the routine to be followed in the event of an air-raid and that a suitable proportion of those persons are trained and equipped to give first-aid treatment, to deal with the effects of gas, and to fight fires.**

Subsection (2) relates to railway undertakings and subsection (3) relates to penalties for failure to make reports which are required.

Power to require measures to be taken.

**33.**

Section 33 relates to duty of public utility undertakers to take the measures specified in notices served on them and to penalties for failure to do so.

General grant in respect of expenses in providing shelter for employees.

**34.—(1) Where any public utility undertakers who, under the preceding provisions of this Part of this Act, have made, or are under an obligation to make, a report as to the measures which they have taken or are taking or proposing to take to provide air-raid shelter for persons employed by them or have been served with a notice requiring them to take such measures, have incurred, whether before or after the passing of this Act, expenses of a capital nature in taking measures**

for that purpose, there shall be paid out of moneys provided by Parliament towards those expenses grants equal to the appropriate proportion of so much of those expenses as the appropriate department considers reasonable :

Provided that—

(a) no grant shall be payable under this section towards the expense of providing any shelter unless either the shelter has been provided before the end of September, nineteen hundred and thirty-nine, or work on the shelter is then in progress or preparatory measures are then being taken and the appropriate department is satisfied that the shelter will be provided within reasonable time thereafter ;

(b) no expenses shall be deemed to be reasonable in so far as they exceed such standard as may be prescribed by regulations of the Minister made with the consent of the Treasury unless they were incurred in circumstances so prescribed.

(2) In this section the expression " the appropriate proportion " means an amount in the pound equal to the standard rate of income tax for the year 1939-40.

Grants in respect of measures to secure due functioning of undertakings.

35.—(1) There may be paid out of moneys provided by Parliament towards approved expenses of public utility undertakers in taking measures, whether before or after the passing of this Act, to secure the due functioning of their undertaking in the event of hostile attack, grants not exceeding one-half of those expenses.

(2) In this section the expression " approved expenses " means such expenses of a capital nature, incurred on such measures, as the appropriate department, acting in accordance with general directions of the Treasury, may approve for the purposes of this section.

(3) This section shall not apply in relation to any railway undertaking or electricity undertaking, and, in relation to any dock or harbour undertaking, shall have effect subject to the special provisions of this Part of this Act as to those undertakings.

Provisions as to railway undertakings.

36.

Section 36 refers to railway undertakings.

Provisions as to dock and harbour undertakings.

37.

Section 37 refers to dock and harbour undertakings.

Provisions as to electricity undertakings.

38.

Section 38 refers to electricity undertakings.

## PART VI: OBSCURATION OF LIGHTS\* AND CAMOUFLAGE†

General duty as to factories, mines and public utility undertakings.

39.—(1) It shall be the duty of the occupier of any factory premises, of the owner of any mine and of the persons carrying on any public utility undertaking to take forthwith any necessary measures to secure that in the event of war, throughout any period of darkness—

(a) no light is allowed to appear from within any building on the premises, or used for the purposes of the mine or undertaking ; and

(b) no lights not within a building remain alight, unless they are essential for the conduct of work of national importance, are adequately shaded, are reduced in power and, save where the Minister otherwise directs, are capable of instant extinction at any time.

Section 39 (2).—Notices may be served by the appropriate authorities requiring the extinction and screening of lights in accordance with the conditions in section 39 (1), but :

\* Methods of dealing with some of the problems involved in this part are given in the Home Office publication : " War Time Lighting Restrictions for Industrial and Commercial Premises," and that publication is discussed in Appendix II.

† The Air Raid Precautions Department of the Home Office have in preparation a handbook on camouflage. Until that appears the official recommendations for camouflaging cannot be given ; but nevertheless certain suggestions for meeting some of the problems will be made in Appendix III.

Section 39 (3).—The conditions in section 39 do not apply to the special factory premises, public utility undertakings and mines covered by the next section.

Provisions  
as to  
processes  
involving  
flames or  
glare.

40.

Section 40 (1).—Where exposed flame or glare are produced as part of the work in factory premises or public utility undertakings, as, for example, in the operation of blast furnaces for the production of steel, and where it is impracticable to obscure those flames or glare by the methods applied to the ordinary lighting of a building, notices may be served requiring that in war time either the flames or glare are not produced during darkness, or that they can be partly or fully obscured; that is to say, more elaborate methods than those adopted for the normal lighting of premises must be applied.

Section 40 (2).—The same requirements as are set out in section 40 (1) above, apply to any dumps of refuse from mines which may be burning or liable to spontaneous combustion.

Camouflage.

41. The Minister may serve on the occupier of any factory premises, the owner of any mine or any public utility undertakers a notice in writing requiring him or them, within the time specified in the notice, to take such measures as may be specified in the notice to secure that the factory premises or, as the case may be, any of the premises of the undertakers, are or can be made less readily recognisable by aircraft in the event of hostile attack.

\* See footnote† on page 916.

Grants  
under  
Part VI.

42.—(1) There may be paid out of moneys provided by Parliament towards the approved expenses of any person on whom a notice has been served under the two last preceding sections in taking the measures specified in the notice, grants not exceeding one-half of those expenses.

(2) In this section "approved expenses" means such expenses of a capital nature as the Minister, or, in the case of measures taken under a notice served by the appropriate department, that department, acting in accordance with general directions of the Treasury, may approve for the purposes of this section.

Penalty for  
failure to  
comply  
with notice.

43.

Section 43 refers to penalties for contravention of the requirements of this Part.

Saving for  
provisions  
of Part V.

44.

Section 44.—The requirements of this part (Part VI) for public utility undertakings are not to be taken as limiting the scope of the requirements of Part V for such undertakings; but grants for the same expenses cannot be claimed under each part.

Provisions  
as to  
practice of  
dimming  
lights.

45.

Section 45.—For the training of personnel in air-raid precautions or for the testing of apparatus to enable traffic to move on unlighted highways, a local authority will have full power to dim or to extinguish lights, even though they may be required, under any other law, to provide those lights on public ways. The same powers are given for the extinction of lights in factories, mines, and public utility undertakings for A.R.P. purposes.

This provision is to be taken as applying since coming into action of the Air Raid Precautions Act, 1937.

## PART VII: MEASURES TO DEAL WITH CASUALTIES AND DISEASE

46.  
47.  
48.  
49.  
50.  
51.

This part relates particularly to the powers of the Minister of Health, to the duties of local authorities in providing premises for medical stores and for the treatment of casualties, to the transfer of officers between local authorities and the Ministry, to payments from Parliament to local authorities and to such other matters which are not likely to come within the scope of the private expert adviser's work. Where necessary reference should, of course, be made to the original document.

## PART VIII: MISCELLANEOUS

Evacuation  
of civil  
population.

52.

Section 52 relates to evacuation and to the serving of notices and to penalties in connection with it.

Requisition  
of premises  
and  
vehicles.

53.

Section 53 relates to the requisitioning of premises and vehicles for air-raid precaution work and to compensation for requisitions.

Special  
provisions  
as to supply  
of water for  
extinguish-  
ing fires.

54.

Section 54.—Subsections (1) to (6) provide for the supply of water by fire authorities, by means of new pipe lines, tanks, etc., of which up to 90 per cent. of the expenses (approved by the Minister in accordance with the directions of the Treasury) may be met by grants.

(7) **Section five of the Act of 1937** (which confers power to purchase land compulsorily) **shall apply for the purposes of any scheme submitted and approved under this section, and where such a scheme provides for the construction of an underground tank** without interfering with the surface of the land, or anything growing therein, except so far as is necessary to provide excavation shafts for constructing the tank and to install any necessary pumping plant or other apparatus specified in the scheme—

- (a) **the fire authority may compulsorily acquire so much of the surface and subsoil of any park, garden, field or open space as is required** for the purpose of the tank, plant or apparatus notwithstanding anything in the enactments relating to London squares or in any other local Act relating to any common, allotment or open space;
- (b) notwithstanding anything in section five of the Act of 1937, section one hundred and seventy-four of the Local Government Act, 1933 (which contains special provisions as to the compulsory acquisition of commons, open spaces and allotments) shall not apply; and
- (c) **nothing shall be paid in respect of the value of the subsoil where the surface is not also purchased.**

Section 54, subsection (8), refers to the Minister's right to refuse any scheme where contaminated water is used.

Power of  
Minister of  
Transport  
to acquire  
plant and  
materials  
for repair  
of roads  
and bridges.

55.

Section 55.—The Minister of Transport may acquire, hold and dispose of plant and materials for the repair of roads and bridges, in exactly the same way as may the Minister for the repair of buildings, as provided in section 56.

Power of  
Minister as  
to stocks of  
building  
material.

**56.—(1) In accordance with arrangements approved by the Treasury, the Minister may acquire and hold or make arrangements for the acquisition and holding on his behalf of stocks of plant and materials for the purpose of their being available for the repair of buildings damaged by hostile attack and may do such things as may appear to him necessary for the storage preservation and transport of those stocks.**



(2) The Minister shall, subject to such conditions as may be determined by the Treasury, have power to dispose of any plant or materials forming part of any such stocks.

(3) The expenses of the Minister under this section shall be defrayed out of moneys provided by Parliament.

Power of local authorities to appropriate lands and buildings for purposes of their civil defence functions.

57.

Section 57.—With the approval of the Minister a local authority may convert to civil defence use any parks, open spaces or buildings which it owns or controls.

Amendment of s. 5 of Act of 1937.

58.

Section 58 refers to the entry by a local authority upon land acquired by compulsion and to compensation.

Compulsory hiring of land.

59.

Section 59 refers to the right of councils to hire land compulsorily.

Powers of bodies corporate as to measures against hostile attack.

60.—Any body corporate carrying on in Great Britain any business or undertaking shall, whether they are public utility undertakers or not, have power and be deemed always to have had power, under any enactment, order, charter, memorandum or articles of association or other document regulating their powers and duties, to take any such measures in relation to their business or undertaking as public utility undertakers, or any class of public utility undertakers, are or can be required to take under any of the provisions of this Act.

Property in equipment, appliances and material provided by the Crown or local authorities.

61.—(1) The property in any equipment, appliances or material provided on behalf of His Majesty under the Act of 1937, free of charge shall remain in His Majesty; and the provisions of this subsection shall continue to have effect notwithstanding the affixing of the equipment, appliances or material to any premises.

In paragraph (b) of subsection (1) of section eleven of the Act of 1937 the word "gifts" is hereby repealed.

(2) Any equipment, appliances or material used in the execution of works executed by a local authority under Part II of this Act shall, notwithstanding the affixing thereof to any premises, remain the property of the local authority.

(3) Any person who being in possession of any such equipment, appliances or material as is mentioned in any of the preceding provisions of this section (being equipment, appliances or material the property whereof remains in His Majesty or in the local authority) fails to use reasonable care for the preservation thereof shall, without prejudice to any other liability, be liable on summary conviction to a fine not exceeding five pounds.

(4) If any equipment, appliances or material which have been affixed to any premises are removed therefrom by or on behalf of His Majesty or the local authority any damage caused by the removal shall be made good.

(5) This section shall be deemed to have had effect as from the commencement of the Act of 1937:

Provided that no person shall be under any liability in respect of anything done or omitted to be done before the passing of this Act which he would not have been under if this Act had not passed.

Enlargement of scope of town planning schemes.

62.—There shall be included among the general objects for which a scheme may be made under the Town and Country Planning Act, 1932, the object of rendering the whole or any part of the area to which the scheme applies less vulnerable to air-raids, and that Act shall have effect accordingly as if the said object were included among the objects enumerated in section one thereof.

Compensation in the event of injury to persons engaged in air-raid precautions activities.

63.

Directions to local authorities to discharge functions with respect to air-raid precautions.

64.

Power to transfer functions of defaulting authority.

65.

Section 63, Section 64, Section 65.—These sections, relating to compensation for personal injuries received on air-raid precaution work, to the carrying out of air-raid precaution duties by local authorities and to the transfer of those duties when an authority has defaulted, do not normally affect the expert adviser in his professional capacity.

## PART IX: SUPPLEMENTAL

Determination of claims to compensation and increases of rent.

**66.—(1) Any question whether any, and if so what, compensation is payable under any of the provisions of this Act providing for payment of compensation or what is the net ascertained cost of works for the purposes of the provisions of Part III of this Act relating to factory premises occupied on short leases or whether any and if so what increases of rent are to be made under the provisions of Part III of this Act relating to increases of rents, shall be referred to and determined by such one or more of the official arbitrators appointed for the purposes of the Acquisition of Land (Assessment of Compensation) Act, 1919, as may be selected by the Reference Committee under that Act.**

**(6) This section shall not apply to any compensation payable in respect of the compulsory acquisition of any land or in respect of personal injuries.**

Subsections (2) to (5) relate to the procedure and powers of the Reference Committee and the arbitrators.

Supplementary provisions as to appeals to Minister.

67.

Section 67 relates to the procedure for dealing with appeals.

Rules as to form of reports.

68.

Penalty for false statements.

69.

Criminal liability of directors, officers, etc.

70.

Sections 68, 69 and 70 relate to the forms reports are to take, to penalties for false statements and to liabilities of directors, managers, secretaries and officers of corporate bodies and public authorities for contravention of the requirements of the Act.

Power of factory inspectors and local authorities to enter premises and penalty for obstruction.

**71.—(1) Any factory inspector or mines inspector and any person duly authorised in that behalf by a local authority having any civil defence functions shall, on producing some duly authenticated document showing his authority, have a right to enter any premises at all reasonable hours for the purpose of—**

- (a) ascertaining whether there is or has been, on or in connection with the premises, any contravention of or failure to comply with the provisions of this Act or of any notice given or regulation made thereunder which it is the duty of the inspector or authority, as the case may be, to enforce;
- (b) ascertaining whether or not circumstances exist which would authorise or require any action to be taken under this Act;
- (c) otherwise facilitating the performance by the inspector or authority, as the case may be, of his or their civil defence functions.

Subsection (2) relates to the application of subsections (2), (3), (4) and (5) of section 287 of the Public Health Act, 1936.

Subsection (3) relates to penalties for obstruction to the inspector or authorized person.

Service of documents.

72.

Section 72 relates to the service of notices etc.

Exemption of certain works from building byelaws, &amp;c.

73.—(1) No requirements or restrictions imposed by or under any enactment, as to the erection, placing or making of buildings, erections or excavations or the reconstruction of or alterations to buildings or the construction, formation or laying out of means of access to or from any road, or as to the submission of plans and specifications, or the giving of notices, to a local authority shall apply in relation to any works executed—

- (a) by a local authority under any of the powers conferred by this Act ;
- (b) by any person on advice given by the local authority in accordance with any provision of this Act specifically requiring such advice to be given ; or
- (c) by any person on the advice of a Government department, whether given before or after the passing of this Act, for the purpose of providing air-raid shelter or rendering any building less vulnerable to hostile attack.

(2) The Minister may make regulations exempting from any such requirements or restrictions as aforesaid such classes of works, executed for the purpose of providing air-raid shelter, as may be specified in the regulations, not being works to which subsection (1) of this section applies.

Covenants to repair and reinstate not to apply to works executed under this Act.

74.—Nothing in any covenant or agreement requiring any person to keep specified premises in, or to restore specified premises to, a particular condition shall authorise or compel any person to interfere with any works executed on those premises under this Act, or subject him to any liability if he does not do so.

Financial provisions.

75.

Section 75 relates to the method of payment of monies by Parliament and to the payment of grants.

Special provisions as to London.

76. Any reference in this Act to a local authority or fire authority shall, in relation to any part of the administrative county of London, be construed as a reference to such one or more of the following authorities, that is to say, the London County Council, the common council of the City, the council of any metropolitan borough, the district surveyor, and the respective overseers of the Inner Temple and the Middle Temple, as may be specified in that behalf by an order of the Minister ; and any such order may provide, in relation to any such authority or authorities, that they shall act, in relation to particular matters, in consultation with any other such authority or authorities.

Consultation with joint committees under Act of 1937.

77.

Section 77 relates to the requirement of councils to refer to the joint committee.

Exercise of powers of Board of Trade.

78.

Section 78 relates to the powers of the Board of Trade.

Variation and revocation of orders.

79.

Section 79 relates to the varying and revoking of orders made under this Act by subsequent Orders in Council.

Definitions of "factory," "factory premises," "mine" and "commercial building" and interpretation of references to

80.—(1) In this Act the expression "factory" means a factory within the meaning of section one hundred and fifty-one of the Factories Act, 1937 :

Provided that—

- (a) the said expression does not include any premises in the occupation of the Crown ;
- (b) the said expression does not include any factory entirely situate in a building not wholly occupied by the occupier of the factory ;

persons  
working and  
persons  
employed.

- (c) **where part of a factory is situate in a building not wholly occupied by the occupier of the factory, that part shall be deemed for the purposes of this Act not to form part of the factory.**

(2) **Where there is a factory in which more than fifty persons work—**

- (a) **the factory ; and**
- (b) **the remainder of any building in which the factory or any part thereof is situate ; and**
- (c) **any land contiguous to the factory which is in the occupation of the occupier of the factory and any buildings on that land,**

**shall together be deemed to constitute factory premises for the purposes of this Act :**

Provided that—

- (a) **no mine shall be included in any factory premises except in accordance with the provision of subsection (4) of this section ;**
- (b) **no premises which are wholly occupied by public utility undertakers for the purposes of their undertaking shall be deemed to be factory premises for the purposes of this Act.**

(3) **In this Act the expression " mine " means—**

- (a) **a mine within the meaning of the Coal Mines Act, 1911 ; or**
- (b) **a mine within the meaning of the Metalliferous Mines Regulation Act, 1872 (as amended by section nineteen of the Mining Industry Act, 1920) ; or**
- (c) **a quarry within the meaning of the Quarries Act, 1894, as amended by section one hundred and fifty-eight of the Factories Act, 1937,**

**being in any case a mine or quarry in or about which more than fifty persons work, and not being a mine or quarry which by virtue of the next following subsection, forms part of factory premises.**

(4) **Where any factory premises are contiguous to a mine and are occupied by the owner of the mine, then—**

- (a) **if the number of persons working in or about the mine exceeds the number of persons working in the factory comprised in the factory premises, the factory premises shall be deemed to form part of the mine for the purposes of this Act ;**
- (b) **if the number of persons working in the factory exceeds the number of persons working in or about the mine, the mine shall be deemed to form part of the factory premises for the purposes of this Act.**

(5) **In this Act the expression " commercial building " means a building in which more than fifty persons work, not being—**

- (a) **a building wholly or mainly occupied as a school, college, hotel, restaurant, club, place of public entertainment or amusement, hospital or nursing home ; or**
- (b) **a building wholly occupied by public utility undertakers for the purposes of their undertaking :**

**Provided that no building which forms part of any factory premises or mine shall be deemed to be a commercial building, and provided that a commercial building shall for the purposes of this Act be deemed not to include any part of that building which is separate and distinct from the remainder of the building and which is used exclusively for residential purposes.**

(6) **For the purposes of this Act the number of persons who work in a factory, or factory premises, or in or about a mine, or in a commercial building shall be taken to be the greatest number of persons who are at work in the factory or premises, in or about the mine, or in the building, as the case may be, at any one time in a normal day, being persons who are employed or who are carrying on business on their own account.**

(7) **References in this Act to persons employed do not include references to persons employed as domestic servants or to persons**

It is understood that, to widen the application of the function of this Act, the number of persons given here as fifty may be reduced.

See note above.

See note above.



otherwise employed in or for the purposes of so much of a building as is used for residential purposes :

Provided that this subsection shall not be construed as affecting the meaning of the word "employer" in the provisions of this Act relating to compensation for personal injuries.

Other provisions as to interpretation.

81. In this Act, except where the context otherwise requires, the following expressions have the meanings hereby respectively assigned to them, that is to say :—

"Air-raid shelter" means protection, otherwise than by war-like means or by any article of apparel, from hostile attack from the air, and "an air-raid shelter" means any premises, structure or excavation used or intended to be used to provide air-raid shelter ;

"Annual value" means, in relation to any premises, the rent at which it is estimated that the premises might reasonably be expected to let from year to year if the tenant undertook to pay the usual tenant's rates and taxes and if the landlord undertook to bear the costs of the repairs and insurance and the other expenses, if any, necessary to maintain the premises in a state to command that rent, such adjustments being made as appear necessary to eliminate any appreciation due to the fact that the premises are or can be made suitable for use in the event of hostile attack and any depreciation due to the fact that the premises are likely to be required for use in that event ;

"Appropriate department" means—

(a) in relation to any railway, canal, inland navigation, dock or harbour undertaking, the Minister of Transport ;

(b) in relation to any gas undertaking, the Board of Trade ;

(c) in relation to any electricity undertaking, the Electricity Commissioners ; and

(d) in relation to any water undertaking, the Minister of Health ;

"Civil defence functions" means any functions conferred or imposed by or under the Act of 1937 or this Act ;

"Diminution in the annual value" means, in relation to the impairment of the usefulness of any premises by reason of the execution of works, the amount by which the annual value of the premises is less than it would be if the works had not been executed ;

"Electricity undertakers" means undertakers within the meaning of the Electricity (Supply) Acts, 1882 to 1936 ;

"Factory inspector" means any inspector appointed under the Factories Act, 1937 ;

"Fire authority" means, subject to the special provisions of this Act with respect to the administrative county of London, the council of a county borough or county district ;

"Land," in any provision of this Act relating to the acquisition of land, includes any interest in land and any easement or right in, to, or over land ;

"Lease" includes an agreement for a lease, if the term to be covered by the lease has begun, and any tenancy, and the expression "lessee" shall be construed accordingly ;

"Mines inspector" means an inspector appointed under the Coal Mines Act, 1911 ;

"Occupier," in relation to any unoccupied land, means the person entitled to the possession thereof ;

"Owners," in relation to factory premises or a commercial building, means—

(a) where there is no lease of the whole building the unexpired term of which is ten years or more, the person in whom the fee simple of the building is vested ; or

(b) where there is such a lease, the person in whom the term created by that lease is vested or, if there are two or more such leases, the person in whom is vested that one of those leases on which all the others are reversionary,

and, in relation to a mine, has the same meaning as in the Coal Mines Act, 1911, the Metalliferous Mines Regulation Act, 1872, or the Quarries Act, 1894, as the case may be ;

"Public air-raid shelter" includes a shelter provided by a local authority, in pursuance of an agreement made under Part II of this Act with the occupier of factory premises or the owner of a commercial building, for the use, in whole or in part, of persons living or working in the factory premises or commercial building ;

"Public utility undertakers" means any persons authorised by any enactment or order to construct, work or carry on any railway, canal, inland navigation, dock, harbour, gas, electricity or water undertaking, and also includes persons who, though not authorised by any enactment or order (other than the Public Health Act, 1875, or the Public Health Act, 1936) to supply gas, are engaged in supplying gas to the public, and for that purpose make use of pipes or mains laid in any highway ; and "public utility undertaking" shall be construed accordingly.

(2) Any premises occupied, or persons employed, by public utility undertakers who carry on a railway undertaking, shall be deemed, for the purposes of this Act, to be occupied or employed for the purposes of their railway undertaking, unless the occupation or employment is wholly or mainly for the purposes of some harbour, dock or canal undertaking carried on by those undertakers.

Application  
to Scotland.

82.

Section 82 relates to the application of the Act to Scotland and to the necessary modifications in wording to cover that application.

Short title,  
citation and  
extent.

83.—(1) This Act may be cited as the Civil Defence Act, 1939, and the Act of 1937 and this Act may be cited together as the Civil Defence Acts, 1937 and 1939.

(2) This Act shall not extend to Northern Ireland.

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# AIR RAID SHELTER CODE

The Provisional Code (H.M.S.O. Price 6d.), together with the Home Office A.R.P. Memorandum No. 10, represent, technically, the most important part of the regulations, and, therefore, both those documents are reproduced.

For purposes of reference the Code has been subdivided by the authors into paragraphs. These paragraphs are not, strictly speaking, part of the Code.

## LIST OF PARAGRAPHS

- |                                                                         |                                                                 |
|-------------------------------------------------------------------------|-----------------------------------------------------------------|
| 1. Scope.                                                               | 18. General references to types of shelters.                    |
| 2. Explanation of standards of protection.                              | 19. Expert advice.                                              |
| 3. Lateral protection.                                                  | 20. Shelters for different buildings.                           |
| 4. Overhead protection (general).                                       | 21. Key-man shelters.                                           |
| 5. Overhead protection (detail).                                        | 22. Position of trenches with regard to buildings.              |
| 6. Debris loading (explanations).                                       | 23. Constructional arrangements for trenches.                   |
| 7. Additional debris load for buildings constructed with bearing walls. | 24. Areas to be avoided for basement shelters.                  |
| 8. Additional debris load for framed buildings.                         | 25. Types of shelters within buildings.                         |
| 9. Additional debris load for exceptionally heavily loaded buildings.   | 26. Trenches under buildings.                                   |
| 10. Dimensions of shelters.                                             | 27. Constructional points for basement shelters (underpinning). |
| 11. Separation of trenches.                                             | 28. Ground floor shelters.                                      |
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| 13. Access to shelters.                                                 | 30. Diversion and avoidance of services.                        |
| 14. Emergency exits.                                                    | 31. Emergency exits.                                            |
| 15. Screen walls for exits into the open.                               | 32. Emergency lighting.                                         |
| 16. Sanitary accommodation.                                             | 33. Entrance to shelters.                                       |
| 17. Position of shelters.                                               | 34. Gas proofing.                                               |
|                                                                         | 35. Examples given in the code.                                 |

## AIR RAID SHELTERS FOR PERSONS WORKING IN FACTORIES AND COMMERCIAL BUILDINGS

Draft of Provisional Code  
[Section 12 Civil Defence Bill]

### TEXT OF CODE

#### 1. STANDARD REQUIREMENTS FOR THE PROTECTION OF PERSONS WORKING IN FACTORIES AND COMMERCIAL BUILDINGS.

##### (1) Scope

The following notes deal with the protection of employees. Protection of plant and equipment, even if vitally important, is outside the scope of this Code.

(1) *Scope.* There is no reason why the standard of protection for people at home should be any different from that for employees.

However, as has been pointed out before, shelters for people at home are not required by the law (except for those people who, owing to the smallness of their income, cannot afford to provide shelter for themselves—Civil Defence Bill, Part IV, Sections 25–31) and such shelters, therefore, are not discussed here. No grant is given for home shelters.

In principle, the following explanations will be valid for home shelters too; but there will be differences in application, and reference to them will be made later in the examination of Memorandum No. 10, "Provision of Air Raid Shelters in Basements."

##### (2) The following standards of protection are required to be provided:

(2) *Explanation of standards of protection.* The approved standards of protection require the specified thicknesses of materials, which thicknesses, however, are not valid if, for any other reason, greater thicknesses are necessary as, for instance, to withstand earth pressure or to carry external or debris loading.

The forces against which these standards of protection are necessary, are explained in other publications of the Home Office, such, for instance, as the "Pamphlet on Shelter from Air Attack." A shelter must resist:—

1. Blast and splinters from a 500-lb. high explosive bomb, exploding not nearer than 50 ft.
2. A direct hit of a light incendiary bomb.
3. Gas.

No direct hit, nor the hit of a 500-lb. bomb within a radius of 50 ft. is considered. (For a smaller bomb this radius can be reduced.)

## TEXT OF CODE

The blast of a bomb bursting 50 ft. away has, under normal circumstances, only horizontal and upward effects and, therefore, does not affect the top protection. (See Fig. 1.) There may, however, be exceptions. For example, a high wall in the neighbourhood of a trench may explode a bomb and the blast may be directed downwards. (Fig. 2.)

Similarly, the path of a splinter is usually that shown in Fig. 3. A splinter, however, unlike blast, alters its direction during flight, and, although a bomb may explode at or below the level of a shelter, splinters may in fact fall on the roof. However, as splinters are not usually of suitable shapes for projectiles in that they have, for their weights, considerable wind resistance to overcome, their velocities and consequently penetrative forces, are rapidly reduced. It can, therefore, be assumed that, under normal circumstances, the effect of splinters falling on the top of a shelter, is very much less than that of splinters hitting a side wall. This does not, of course, hold good in the case of an explosion of the type shown in Fig. 2, where splinters would strike the roof of the shelter with full piercing force. Upon such considerations as the foregoing, different standards of protection are based, namely:—

- (a) Lateral protection (higher standard).
- (b) Overhead protection (lower standard).

The different standards must be adopted with discretion, for obviously if a possibility of explosions as shown in Fig. 2 exists, the overhead protection should be made of the same standard as that of the lateral protection.

## (3) Lateral Protection

The standard of lateral protection is given by:

Mild steel, not less than  $1\frac{1}{2}$  in. thick,

\* or solid brickwork or masonry, not less than  $13\frac{1}{2}$  in. thick,

† or reinforced concrete, not less than 12 in. thick,

or earth, sandbags, ballast or broken stone, not less than 2 ft. 6 in. thick,

or combinations of these materials in suitable thicknesses,

‡ or by other materials which can be shown to be equally effective for the purpose,

or by placing the shelter below ground level.

\* This value is appropriate for sound brickwork in cement mortar, hydraulic lime mortar, or cement-lime mortar, or for coursed masonry in sound condition. For old brickwork, where the mortar is found on inspection to be weak and friable, and for rubble masonry the thickness of lateral protection should be increased up to double the values indicated according to condition.

† This value is appropriate for dense concrete of structural quality containing not less than 112 lb. of cement to  $2\frac{1}{2}$  cubic feet of fine aggregate and 5 cubic feet of coarse aggregate.

‡ Alternative materials can only be permitted when specially authorized.

(3) Lateral protection. The actions of splinters and blast are instantaneous, and in the case of blast immediate reversal of the effects take place.

It is important to bear in mind that the action of the forces due to blast on a beam, for example, expresses itself in two steps:—

- (i) The primary effect of shear only.
- (ii) The secondary effect of bending.

Under a very sudden impulse there is little time for bending stresses to develop and invariably shear failure occurs.

For this reason the requirements for the standard of protection can be given in the case of a member subjected to bending, independent of the span, i.e. of the distance between the supports of the beam.

To resist shear the thickness of material is the important factor. "Thickness" in this case means "thickness of solid material." A hollow block, for instance (Fig. 4) can be considered to have the thickness represented only by the thicknesses of its walls.

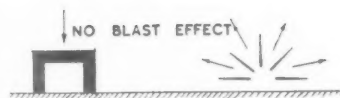
The resistance of a material is composed of:—

- (a) Its resistance to shear.
- (b) Its resistance to disintegration.

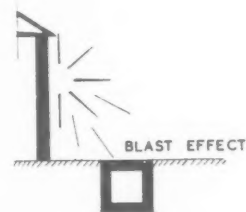
That is why the required thicknesses of different materials are not in true inverse proportion to their normal shear strengths. For example, against ordinary shear, reinforced concrete 12 in. thick, would have a much greater resistance than  $13\frac{1}{2}$  in. of brickwork; but against blast and splinters they are of practically equal value. The Code makes no mention of mass concrete; but actually mass concrete, of mix 1 : 6, may be considered to be of the same strength as good brickwork and, therefore, a thickness of  $13\frac{1}{2}$  in. should be sufficient where that thickness is required in brickwork.

The reinforced concrete considered here is identical to that commonly known as "1 : 2 : 4 mix."

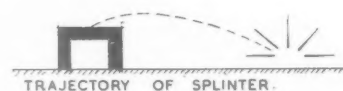
For "structural concrete" the following rules should be observed: A proper grading of



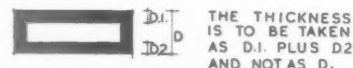
1 Usually no overhead blast.



2 Condition permitting overhead blast.



3 Possibility of overhead splinters but reduced effects.



4 Effective thickness of hollow sections.

THE THICKNESS IS TO BE TAKEN AS D1. PLUS D2 AND NOT AS D.



aggregate is of particular importance and cube tests are recommended. It is not necessary to test the crushing strength, but the weight should be ascertained. The correct weight may be taken at the rate of 145 lb. per cub. ft. and if the actual weight should be considerably less, a consequent increase in thickness should be made. There is no particular advantage in increasing the richness of the mixture. No indication is given as to what amount of reinforcement would be considered adequate; but the authors suggest that as the minimum, two layers of vertical rods of  $\frac{1}{2}$  in. diameter at 9-in. centres, and two layers of horizontal rods of  $\frac{3}{8}$ -in. diameter at 6-in. centres (Fig. 5) or equivalent amounts should be provided; but it should be appreciated that, in any case, the effect of reinforcement is small. In particular circumstances the thickness of reinforced concrete walls may be reduced to 10 in. by the introduction of special shear reinforcement (Fig. 6) and such reinforcement should consist of rods of at least  $\frac{1}{2}$  in. diameter, running in the direction of the wall thickness, i.e. from front to back. The spacing between these shear rods should not exceed 6 in. either vertically or horizontally, and in this case the spacing of the main vertical rods should be reduced to 6 in. and further the diameter of the main horizontal rods should be increased to  $\frac{1}{2}$  in.

This arrangement, however, is uneconomical and should be recommended only where local circumstances make its use imperative.

Different materials may be used in layers to provide, in conjunction, the total thickness necessary to afford the standard of protection required; and the thicknesses of the individual layers should be proportioned in the following way:

If  $t_1$  = the required thickness of one material when used alone, and

if  $c_1$  = the actual thickness of that material which it is proposed to adopt

then a factor  $a = \frac{c_1}{t_1}$  can be found.

Further if  $t_2$  = the required thickness of the other material when used alone, and

if  $c_2$  = the required thickness of the second material when used in conjunction with a thickness  $c_1$  of the first material

then  $c_2 = (1 - a) t_2$

For example, if sandbags and reinforced concrete are to be used in combination (Fig. 7):

$t_1$  (reinforced concrete) = 12 in.

$t_2$  (earth) = 30 in.

If it is proposed to use 4 in. of reinforced concrete:

$$a = \frac{4}{12} = .33$$

$$\therefore c_2 = (1 - .33) 30 \text{ in.}$$

$$= .66 \times 30 = 20 \text{ in.}$$

Another possibility would be two brick walls filled with earth (flower pot type) and held by anchor bolts with strong washers (Fig. 8):

$t_1$  (earth) = 30 in.

$c_1$  = 10 in.

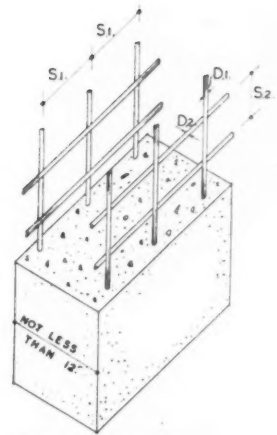
$a = \frac{1}{3}$

$t_2$  (brickwork) = 13.5 in.

$$c_2 = (1 - \frac{1}{3}) \times 13.5 = 9 \text{ in.} = 2 \times 4.5 \text{ in.}$$

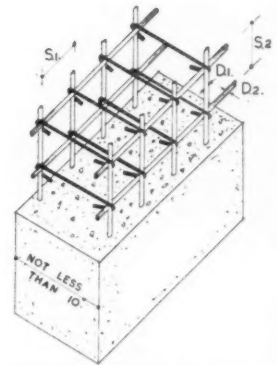
A wall of any material can afford proper protection only if it is itself adequately supported laterally. For example, steel plates used for lateral protection should be fixed to frames or otherwise stiffened. (Fig. 9.) Walls should be restrained in position both at the top and at the bottom. (Fig. 10.)

It should always be borne in mind that an insecurely fixed mass of material, although of the requirements for withstanding blast and splinters,



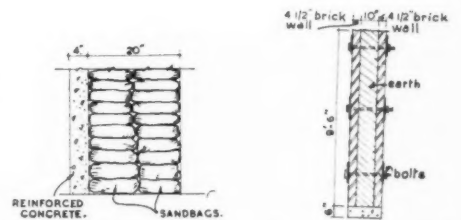
D1 NOT LESS THAN  $\frac{1}{2}$  INCH.  
D2 NOT LESS THAN  $\frac{3}{8}$  INCH.  
S1 NOT GREATER THAN 9"  
S2 NOT GREATER THAN 6"

5 Ordinary reinforced concrete.



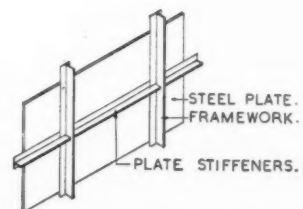
D1 NOT LESS THAN  $\frac{1}{2}$  INCH.  
D2 NOT LESS THAN  $\frac{1}{2}$  INCH.  
S1 NOT GREATER THAN 6"  
S2 NOT GREATER THAN 6"  
 $\frac{1}{2}$  TIES AT EVERY JOINT.

6 Special reinforced concrete.



7 Reinforced concrete and sandbags in combination.

8 Brickwork and earth filling in combination.



9 Framing and stiffening of steel plate.

## TEXT OF CODE

may be dislodged and do as much as, or more damage than the blast would have done.

In addition to the materials specified in this part of the Code there are other materials such as those produced or stored at the place where a shelter is required, which might be shown to be equally effective in providing protection. Such materials may be cotton or wool bales, paper reels, concrete or steel pipes, etc., but shelters constructed from them should be considered as provisional, for these materials are hardly adaptable to permanent shelters. Where such a material is used the overall thickness,  $t$ , may be calculated approximately from the formula:

$$t = \frac{270,000}{s^2}$$

in which  $t$  is in inches, and  $s$  is the weight in lbs. per cubic foot.

The provision made in the preceding paragraph, that care should be taken to prevent the dislodging of masses of the material, will be particularly important for such improvised shelters, and some of the precautionary measures will be discussed in appendix VI, where examples are given.

Where a shelter is below ground level, the question of lateral protection by means of earth becomes rather complex; but it will be discussed in conjunction with the separation of shelters. (Paragraph 11.)

The standard of lateral projection given here, applies only to the outside walls of shelters and not to division walls. (See paragraph 12.)

## (4) Overhead Protection.

The standard of overhead protection is given by:

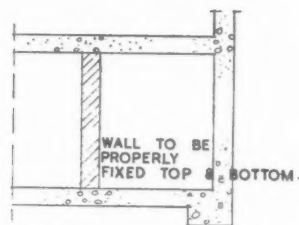
(4) *Overhead Protection (general).* The overhead protection provided here is only that against splinters of reduced velocity, falling shells, small incendiary bombs and similar missiles. It is insufficient in both of the following cases:

1. Where there is the possibility of overhead blast (see Fig. 11) in which case the overhead protection should not be less than the lateral protection.

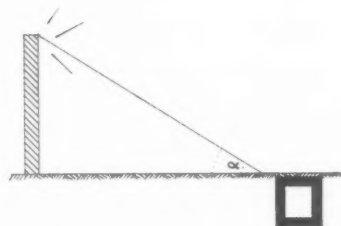
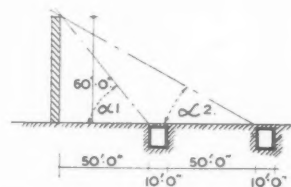
There is a danger of overhead blast if any portion of a vertical face of a building, or any other obstacle which might cause the explosion of a bomb, lies outside an angle of more than 30 degrees to the horizontal from any point on the roof of the shelter. (Fig. 11.)

*Example.* A long building (Fig. 12) is 60 ft. high, to the eaves, and a trench (A) is to be provided parallel to the building and at a distance of 50 ft. from it. A second trench (B) is to be provided a further 50 ft. away from (A) and again parallel to the building. In this case the overhead protection of shelter (B) can be that which is given in the Code, whereas that for shelter (A) should be equal to the lateral protection required under ordinary circumstances.

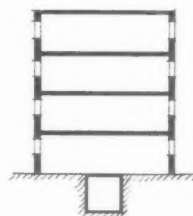
2. Where the danger of falling debris exists, the overhead protection is to be calculated in accordance with the loads given under paragraphs 7, 8 and 9. Such a danger must be assumed where a building is either (a) on top of the shelter (Fig. 13) or (b) where any part of a building lies outside an angle of 65 degrees from the horizontal measured from any point on the shelter roof. (Fig. 14.) The value of this angle, namely 65 degrees, is, however, to be adopted with discretion. It refers to the normal type of multi-storey building and there is very little difference if the building is of framed construction. Nevertheless, particular attention must be given to such buildings which have a tendency to crash by pivoting about any point as, for example, chimneys and the framed walls of hall buildings. (Fig. 15.) For such buildings, the limit of the angle should be taken as 45 degrees and not 65 degrees.



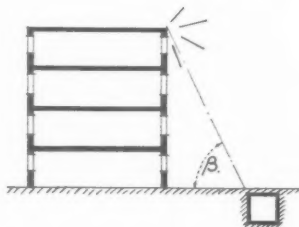
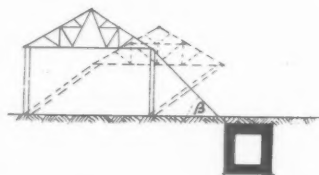
10

11 When  $\alpha$  is greater than  $30^\circ$  protection against overhead blast should be provided.

12 Example of illustrating where overhead protection against blast is required—see text.



13 Debris load to be taken on roof of shelter due to building over.

14 Debris load to be taken on roof of shelter where  $\beta$  is greater than  $65^\circ$ .15 Debris load to be taken on roof of shelter where  $\beta$  is greater than  $45^\circ$ .

## TEXT OF CODE

- (5) Mild steel, not less than  $\frac{1}{4}$  in. thick,  
 § or concrete, not less than 6 in. thick,  
 || or concrete of structural quality, not less than 4 in. thick,  
 ¶ or brickwork or masonry arches where the arch ring is not less than 8½ in. deep,  
 or earth, sandbags, ballast or broken stone, not less than 1 ft. 6 in. thick,  
 or combinations of these materials in suitable thicknesses,  
 \*\* or other materials which can be shown to be equally suitable for the purpose.

§ Concrete for overhead protection should contain not less than 112 lb. of cement to 12 cubic feet of fine and coarse aggregate in combination.

|| Concrete of structural quality should contain not less than 112 lb. cement to 2½ cubic feet of fine aggregate and 5 cubic feet of coarse aggregate.

¶ This depth of arch ring is appropriate for sound brickwork or masonry with the haunches properly filled, and with proper lateral support at the abutments.

\*\* Alternative materials can only be permitted when specially authorised.

(5) *Overhead Protection (detail).* For general remarks on the reasons why thicknesses for the standard protections are independent of the spans see paragraph 3.

All materials providing overhead protection must be properly supported and secured in position. Any loose materials might prove fatal. Although combinations of different materials are permitted, as for lateral protection, care is to be taken to ensure that in such combinations one part does not act merely as dead loading. For example, the arrangement of the 16-gauge steel sheet with sandbags shown in Fig. 16 is to be avoided, unless the sandbags are so arranged that by an arching effect they become self-supporting as in Fig. 17.

Even in this case to ensure the arch action the rise should not be less than one-fifth of the span.

Mass concrete (112 lbs. of cement to 12 cubic feet of aggregate, generally known as 1 : 10 mix) should be used only in the form of an arch. (Fig. 18.)

The supports, of course, must be able to withstand the thrust of the arch, and in calculating the thrust the superload should be taken as not less than 100 lbs. per square foot. Where a greater superload is known to occur, that greater load must obviously be considered. The foregoing remarks refer also to brick and masonry arches, of which the thickness must not be less than 8½ in. at any point.

Where existing floors are used, for example in basements, the construction will frequently be found to consist of mass concrete in the form of 6-in. slabs. Being without tensile reinforcement, these slabs hardly comply with the requirements for overhead protection. They do in fact behave as arches of about 2 to 3 in. thickness and the lower part of the slab frequently exhibits cracks. It is suggested that these flat concrete slabs should not be considered as sufficient.

In certain cases of mass concrete slabs which are thicker than 6 in. it may be possible for an effective arch to lie within the overall depth of the slab, and for the recommended conditions for such cases reference should be made to paragraph 27. Concrete of structural quality, that is to say, concrete of a mixture not less than 1 : 2 : 4, is considered to be adequate if 4 in. thick. Such concrete must be reinforced and there should be not less than 3 rods,  $\frac{3}{8}$  in. diameter, per ft. run in one direction and one rod, of  $\frac{1}{4}$  in. diameter, per ft. run in the other direction. (Fig. 19.) Alternatively, 3 rods of  $\frac{5}{16}$  in. diameter may be used per ft. run in both directions or reinforcement of equivalent strength (Fig. 20). Where calculation shows that a greater amount of reinforcement is necessary, that greater amount must be provided.

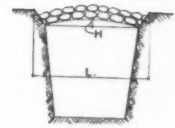
Ordinary rod steel reinforcement, because it does not form a continuous plane, cannot, in itself, be considered to be a protective thickness of material, nor to act as a layer in combination with the concrete. Only if sheet steel covering the whole of the lower surface and properly bonded to the concrete is used as reinforcement can the reinforcement be considered to contribute towards the required thickness.

Ordinary sheet steel or corrugated sheet on the soffit of the concrete does not provide sufficient bond; but a dovetailed sheet, however, does satisfy this requirement.

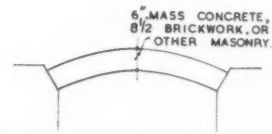
A dovetailed sheet  $\frac{1}{8}$  in. thick (16 gauge) with 3 in. of concrete on top (Fig. 21) is sufficient in accordance with the formula below, and it provides an economical and light form of top protection.



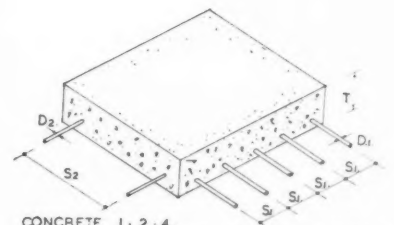
16 To be avoided. Sand-bags merely dead weight.



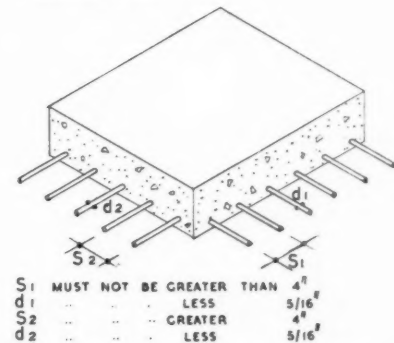
17 May be permitted if H is not less than  $\frac{1}{5}$  L.



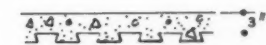
18 Pure arch construction.



19 Minimum reinforcement for reinforced concrete slab.



20 Minimum requirement for two-way reinforcing.



21 Combination of concrete and steel to afford the required thickness. The steel plate also acts as reinforcement.

## TEXT OF CODE

The steel sheet can be used as shuttering for the concrete top. The steel should not be galvanized, as galvanizing reduces the bond with the concrete; but the soffit must be kept painted to prevent its deterioration.

In general, thicknesses of materials in combination can be found in the manner given for lateral protection (paragraph 3).

$$\begin{aligned} c_1 &= \alpha t_1 \\ c_2 &= (1 - \alpha) t_2 \end{aligned}$$

in which  $\alpha$  is the ratio of the proposed thickness of one material to the thickness of that material which would be required if it were being used alone.

## (6) Debris Loading

For shelters in buildings it is necessary to provide a roof or floor over having sufficient strength to support the fall of debris consequent on demolition of the superstructure. The superimposed loads shown in the table below should be assumed as a reasonable provision against the fall of debris. These loads are to be taken as additional to the normal superimposed and dead loads which the floor or roof would be designed to carry for normal purposes, and support must be given where necessary to the floor panels as well as to main beams and joists.

(6) Debris Loading (Explanations).—Reference has already been made to "debris loading" under paragraph 4, but it is mentioned again here to point out that although the Code provides that shelters in buildings must be provided with a roof having sufficient strength to withstand debris load, there is little doubt that this requirement should apply also to shelters immediately outside buildings. Criteria have been given in connection with Figs. 14 and 15. The requirements will apply not only to trenches in the open, but also to basement shelters extending under the pavement, and particularly to emergency exits from basements. In fact, the loads given in paragraph 7, although reasonable for shelters inside a building, fall short of what might be expected to be the debris load on shelters immediately outside. Whereas, falling masses of masonry, etc., inside a building would be checked at every floor and would, consequently, not obtain a very high velocity, there is nothing, except negligible wind resistance, to check the velocity of part of the external wall of a six-storey building which falls outwards. In fact, the construction necessary to withstand such falling debris would have to be so heavy that it is strongly to be recommended that such areas immediately surrounding a building of more than three storeys should not be used as shelters. The same argument applies, of course, to such areas within a building that are at the bottom of open wells or light areas. Exception may be made to this rule, as in the case of accessory rooms, etc., and reference should be made to paragraphs 9 and 14.

Debris load must be taken as an addition to the superload, and not as replacing it. Only where it is absolutely assured that no live load can act, while the possibility of the collapse of a building exists, is it permitted to replace the live load by debris load. In existing work, all constructional members which are to form any part of a shelter must be checked and, if necessary, strengthened. These members are usually slabs, beams, girders, columns and bearing walls; but retaining walls may also be involved if there is a chance of a surcharge on the outside. (Fig. 22.) (See also paragraph 27, where a number of special problems are discussed.)

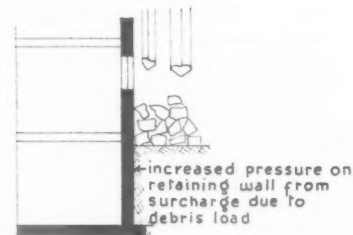
## (7) Additional superimposed loads to be assumed on the roofs over shelters to provide against the fall of debris from the superstructure.

(1) For buildings when loads are carried on load bearing brickwork or masonry.

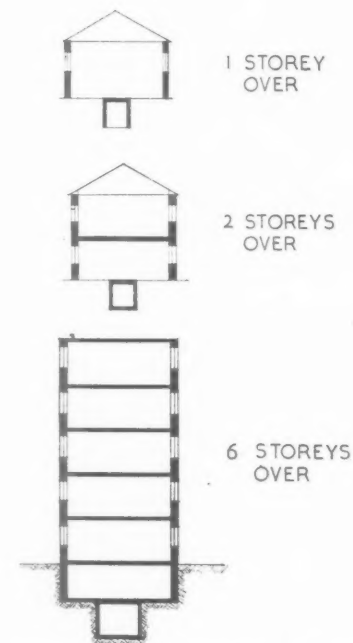
| Number of floors over | Debris load to be assumed lb. per sq. ft. of floor area |
|-----------------------|---------------------------------------------------------|
| 2                     | 200                                                     |
| 3 or 4                | 300                                                     |
| More than 4           | 400                                                     |

(7) Additional Debris Load for Buildings constructed with Bearing Walls.—In the table given in the Code, the expression "floor" may be misleading. What is meant actually is "storey." If there are only one or two storeys standing over a shelter, a debris load of 200 lb. per sq. ft. is to be adopted in the calculations of the shelter roof. (See Fig. 23.)

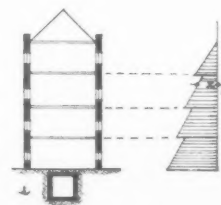
If there are three or four storeys, the debris load must be taken as 300 lb. per sq. ft., and if a greater number of storeys, 400 lb. per sq. ft. will be the required load. No difference is made whether a storey has a floor or a roof over it, and it must be



22 Secondary effects of debris loads must be investigated.



23 Assessment of "floors" for debris loading.



24 Velocity diagram for falling debris.



## TEXT OF CODE

appreciated that walls usually contribute more to the debris load than do floors.

In order to explain the character of these loads, a velocity diagram is drawn, in principle, in Fig. 24. The velocity of a falling mass at any point X is represented by the distance  $x$ . The curve of the velocity in any storey height is a parabola; but the maximum velocity attained, which is just as the floor is struck, is checked by the floor, and immediately below, i.e. after penetration the velocity is relatively low in the upper parts of the storey height. Further, the kinetic energy of a falling mass is proportional to the square of its velocity, and as the kinetic energy represents the destructive power, it is clear that the least damage will be done to a shelter at any given level if its roof is near to the soffit of any existing floor above.

It is suggested that where the shelter roof is within 3 ft. of the soffit of an existing floor (underside of floorboards or concrete slab) there appears to be no need to increase the load for the floor immediately over.

For example, the load of the building shown in Fig. 25 should be taken as 300 lb. per sq. ft. (four storeys) if  $x$  is less than 3 ft. and 400 lb. per sq. ft. (five storeys) if  $x$  is not less than 3 ft. For the exceptions to the superload, see paragraph 9.

(8) (2) For buildings when loads are carried on steel or reinforced concrete frames the "debris load" may be assumed at 200 lb. per sq. ft. of floor area, irrespective of the number of floors over.

(3) For buildings which consist of a combination of load-bearing brickwork or masonry with framed construction, intermediate values for debris loads, based on the judgment of competent architects or engineers may be taken.

(8) *Additional Debris Load for Framed Buildings.*—Steel or reinforced concrete frames are treated differently, for experience has shown that such buildings do not readily collapse totally, and that the debris consists, as a rule, only of individual wall and floor panels and partition walls in one or two storeys (except, of course, in the immediate neighbourhood of a direct hit, which is not considered here.) It is well, however, to distinguish between certain framed buildings as not every such building really possesses the stiffness which is required.

It can be held, definitely, that steel-framed buildings, constructed in accordance with the London County Council By-laws, or B.S.S. 449, and properly cased, will offer satisfactory resistance, due particularly to the regulations that columns must be continuous (Fig. 26). Reinforced concrete frames also exhibit the necessary stiffness: but the thickness of columns is sometimes too small to withstand the racking forces of blast satisfactorily, and it is very advisable to consider a building as framed only if the columns in at least two storeys above a shelter are at least 10 in. thick (Fig. 27). So-called "monolithic" reinforced concrete buildings without columns, but with load-bearing reinforced concrete walls of 4, 5 or 6 in. thickness, cannot be considered superior in lateral stiffness to other buildings with load-bearing walls and the loads given in paragraph 7 should be applied (Fig. 28).

Buildings, which consist of a combination of load-bearing brickwork or masonry, with framed constructions, can be brought under three main heads:—

(a) Buildings in accordance with the definition of framed buildings, given for instance in the London County Council By-laws, but using party walls as bearing walls in accordance with that definition (Fig. 29).

(b) Buildings composed of brick bearing external and/or party walls, with inner skeletons of steel or reinforced concrete, which in themselves comply with the regulations (Fig. 30).

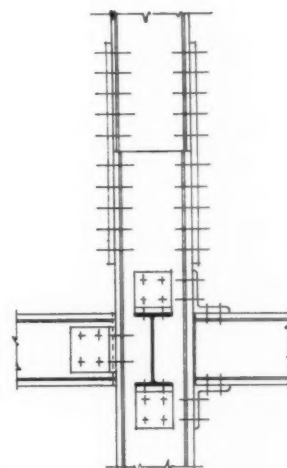
(c) Buildings, similar to those of type (b), but of which the skeleton frames do not comply with the regulations. In London, for instance, up to January 1, 1938, such internal frames did not have



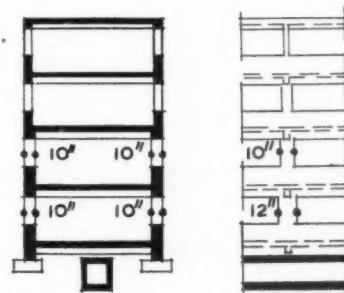
**25** Influence of distance from top of floor immediately above to top of shelter on number of storeys to be taken as determining debris load.

Example: If  $x$  is less than 3 ft. 0 in. take 4 storeys, i.e. 300 lb. per sq. ft.

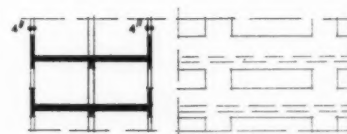
If  $x$  is greater than 3 ft. 0 in. take 5 storeys, i.e. 400 lb. per sq. ft.



**26** Typical beam-column details in steel-framed building.



**27** Reinforced concrete frame to have columns not less than 10 in. thick in at least two storeys above shelter in order that building may be considered as "framed."



**28** Such "monolithic" structure should not be considered as "framed" for purposes of debris loads.

## TEXT OF CODE

to comply with any specific regulations, and, consequently, the standards of construction vary enormously (Fig. 31). These buildings include very often columns of which separate lengths are not connected by flange plates, and in many buildings cast-iron columns can be found carrying beams inadequately secured to the caps (Fig. 32).

Where buildings in group (a) (Fig. 29) are concerned and where the party walls are in good condition, the debris load can be taken as 200 lb. per sq. ft.

For buildings in group (b) (Fig. 30) in which the joists are anchored to good-quality brick walls which can be shown to take the normal stresses occurring in accordance with the London County Council By-laws, 1938, Part IV, Section 3, or the Model By-laws of the Ministry of Health, the debris load can be taken as 200 lb. per sq. ft. if there are at least two floors of solid concrete or hollow tile construction above the level at which the load will be applied, and 300 lb. per sq. ft. if there are timber floors throughout.

Buildings in group (c) (Fig. 31) should be judged from the efficiency of the anchorage of joists to the brick walls, the stiffness of connections, the capacity of the walls to carry the imposed stress, etc.

Where any of these requirements is not satisfied, the debris load should be assumed to be that of an ordinary building with load-bearing walls: where they are all satisfied, the building can be treated as though one of group (b).

(9) 1. The superimposed loads given in the table above are a reasonable provision for the collapse of buildings of normal construction. If the buildings have abnormal features, such as heavy colonnades, pediments, cornices, etc., which would be likely to produce abnormal debris loads, higher values must be taken according to the judgment of competent architects or engineers. The superimposed loads given in the table above are only sufficient to cover the fall of moderate amounts of light plant and equipment. They are not sufficient to cover the fall of heavy machinery, nor will it often be economically possible to strengthen the roof over a shelter sufficiently to withstand the fall of any but very light machines. Where the fall of machinery would constitute a serious danger to personnel in a shelter, protection must be sought elsewhere unless alternative accommodation can be found for the machinery.

2. The superimposed loads given in the table above are a reasonable provision for the fall of debris for members designed in accordance with normal methods using normal working stresses.

(9) *Additional Debris Load for exceptionally heavily loaded Buildings.*—The loads given under paragraph (7) can reasonably be applied only inside a building. The unimpeded fall of a piece of dislodged brickwork from a height of 50 or 60 ft. presents a more difficult problem (Fig. 33). Where shelters must be placed adjacent to buildings (see paragraph 6 in which such an arrangement is suggested as being unsatisfactory) a debris load of 225 lb. per sq. ft. for every 10 ft. of height will be sufficient in most cases: but even with the provision for such a load it cannot be guaranteed that extraordinarily heavy pieces of debris would not penetrate the roof.

It will be well here to consider, in principle, the effects of falling debris.

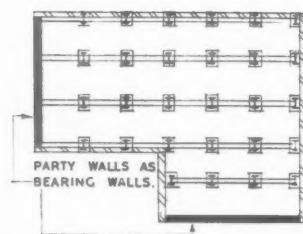
A freely falling mass accumulates a certain amount of energy which is equal to its weight multiplied by the height of the fall. This energy must be taken up by the material on which it falls, by deflection, disintegration or generation of heat and sound. Where the falling material can be expected to be of less hardness than the construction on which it lands, the destruction might be expected to start with the falling parts, and accordingly less of the energy is to be taken by deflection.

Where they are equally hard, both the falling masses and the construction will share the destructive action, and if the deflection, which can take place without failure of the material, is not great enough, a part at least of the construction will be destroyed. Where a layer of soft material is applied on top of the construction, the damage to this top layer may so absorb the energy, that collapse of the material below will not take place.

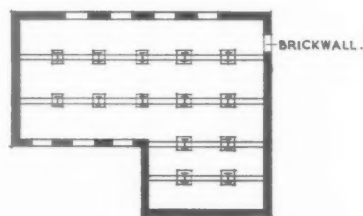
The energy of a mass of masonry, falling from a greater height than 10 ft., is too great to be dissipated by the deflection of a roof affording the normal overhead protection.

However, three courses are open for securing protection against debris falling from a great height:—

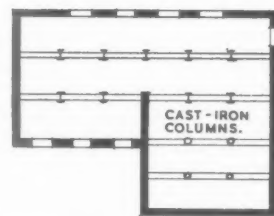
(1) By a filling of earth or other soft material on



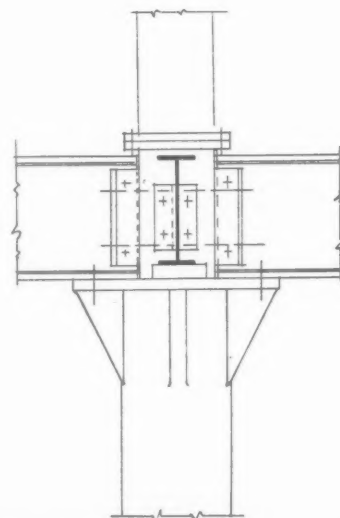
29 Skeleton frame and party walls.



30 Internal frame and external bearing walls.



31 Internal beams and columns and bearing walls.



32 Typical detail of cast iron columns. Should not be considered as "framed" structure.

top of the shelter, the thickness being not less than one-twentieth of the height of the adjacent structure (Fig. 34).

(2) By covering the shelter with a hard material, which would cause disintegration of the falling material before the shelter could be affected (cast-iron or even glass would be satisfactory, although the latter might be impracticable).

[This method has not been investigated scientifically, and no suggestions can yet be made about thickness of materials.]

3. By a combination of a hard material on top of a layer of earth or other soft material.

Where heavy colonnades, pediments, cornices, etc., appear on a building, it is suggested that the debris load should be increased by 50 per cent. of the normal value inside the building, for a width which is equal to the maximum storey height. For the purpose of the debris load thus increased, any unnecessary feature weighing more than 200 lbs. per foot run may be regarded as the "heavy construction" necessitating the increase.

Example: The building shown in Fig. 35 has particularly heavy features at the front, but nevertheless, the shelter must, for certain reasons, be arranged in the basement near the front. In this case it is advisable to reckon on 600 lbs. per square foot on the front 12 ft. of the shelter (this being equal to the maximum storey height), whilst the remainder would have to be calculated for 400 lbs. per sq. ft. debris load, there being 5 storeys on top.

Except in a properly framed building, with solid concrete floors, heavy machinery will prove a danger to all shelters. Any machinery weighing more than 50 lbs. per sq. ft. of floor can be regarded as "heavy" for the purpose of this argument.

Stored materials also, may prove a danger; but only when, as in the case of heavy machinery, they are on upper floors and not on the floor which has to withstand the falling loads. There is no reason why such machinery or stored materials should not stand on the floor which is to resist the debris load, provided of course, that their weights have been allowed for in the design.

If there is any alternative, shelters should not be arranged immediately below heavy machinery or stored materials on upper floors. The area which might be regarded as liable to damage from such falling loads may be taken as their own floor areas increased, on all sides, by a distance equal to half the greatest storey height between the shelter and the heavy load. (Fig. 36.) In many cases, sufficient space for a shelter will be available avoiding the affected areas in a basement, and a re-arrangement of the machinery so as to have all the heavy machines above each might prove helpful.

Where, however, it is necessary to arrange a shelter immediately beneath a heavy load, the following rules should be observed:

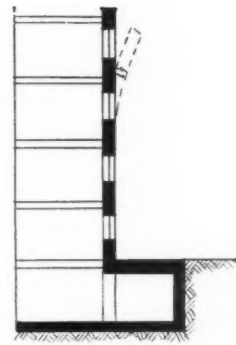
Where, on any floor, the load is  $p$  lbs. per sq. ft. (stored material or heavy machinery) the area affected should be calculated for a debris load of

$p_1 \left( \frac{p}{50} \right)$  in which  $p_1$  is the debris load specified by the Code. This is independent of whether such load occurs only once or in every floor. If such load should occur, however, only in the first or second floor of a multi-storey building, one can assume

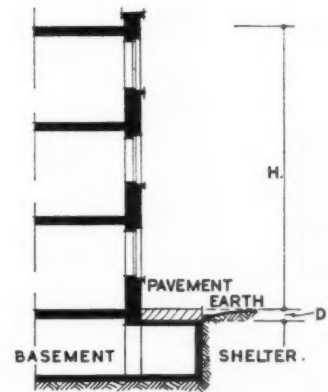
$p_1 = 200$  lbs. per sq. ft.; and if only in the 3rd or 4th storey

$p_1 = 300$  lbs. per sq. ft.

In no case however, should the load, against which provision is to be made, be less than that specified in paragraph 7 or 8, even if it should be

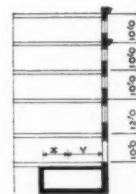


33 Masonry falling outside a building calls for increased debris load.



'D' TO BE NOT LESS THAN  $\frac{H}{20}$

34 Increased protection is required over any part of a shelter or exit outside the building.



35 For a building with heavy cornices, etc., the debris load should be increased 50 per cent. for a width inside equal to the greatest storey height above.

Example: Over  $x$  take 400 lb. per sq. ft. (5 storeys). Over  $y$  (12 ft.) take 600 lb. per sq. ft.



36 Areas to be considered vulnerable to damage by heavy machinery or stores:—

If  $z$  = greatest storey height

$x_1 = x + z$

$y_1 = y + z$

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calculated by the above formula to a less value. For instance, in a six storey building with machinery weighing 75 lbs. per sq. ft. on the first or second floor, the formula gives a load :

$$200 \times \frac{75}{50} = 300 \text{ lbs. per sq. ft.}$$

whereas, under paragraph 7, a load of 400 lbs. per sq. ft. is required. The latter value should be adopted.

On the other hand, if the machinery weighs 150 lbs. per sq. ft. the calculated value :

$$200 \times \frac{150}{50} = 600 \text{ lbs. per sq. ft.}$$

should be taken.

Apart from the floor to carry these loads it is recommended that earth or sandbags, to a thickness of not less than  $\frac{1}{20}$  of the height from which such machinery falls (but with a minimum thickness of  $1\frac{1}{2}$  ft.), should be provided.

In the case only of stored materials which are relatively soft, a continuous steel plate, of a thickness of not less than  $\frac{1}{100}$  of the height from which such materials fall (with a minimum thickness of  $\frac{3}{8}$  in.) might be used, or a combination 1 ft. 6 in. of earth or sandbags and a steel plate of a thickness not less than  $\frac{1}{100}$  of the height with a minimum thickness of  $\frac{1}{4}$  in.). (Fig. 37.)

**(10) Space Required in Shelters**

For shelters ventilated naturally by way of the normal exits and entrances, but without mechanical ventilation, the calculation of the number of persons who can be accommodated shall be made according to the following rules.

For trench or tunnel shelters wholly or partly below ground level, where the width of the trench or tunnel measured inside the lining does not exceed 7 feet 6 inches, and where there are openings to the air at either end of each bay or traverse, and where not more than 50 persons are accommodated in any one bay or traverse, or where the complete shelter does not accommodate more than 12 persons there shall be not less than  $3\frac{3}{4}$  square feet of floor area for every person in the shelter.

\* For other shelters wholly or partly below ground level there shall be :

- not less than 6 square feet of floor area for every person in the shelter ;
- not less than 50 cubic feet capacity for every person in the shelter ;
- not less than 25 square feet of surface area of walls, floor, and roof for every person in the shelter.

\* In applying these rules to any particular case the accommodation allowable shall be based on whichever rule provides for the lesser number of persons.

(10) *Dimensions of shelters.* This paragraph must be read in conjunction with paragraphs 34 and App. I. —gas-proofing of shelters and ventilation. Whilst shelters need not be gas-proof, they are to be so designed that, should the emergency arise, they can be made gas-proof. This means that ventilation by way of the normal exits and entrances will no longer be possible. Either of two methods may be used :

(1) To provide in every shelter which is constructed in accordance with the sizes given here, ample accommodation for the future installation of mechanical ventilation and air filtration plant.

(2) So to increase the size of the shelter that with all entrances and exits closed, artificial ventilation will not be required within the period over which the concentration of gas remains dangerous (75 ft. of surface area required, see Appendix I).

In most circumstances policy (1) above will be preferable, due to the difficulty of providing the increased size otherwise required. There may, of course, be cases in which it will be more reasonable to provide the additional accommodation and to save the cost of air filtration plant and forced ventilation.

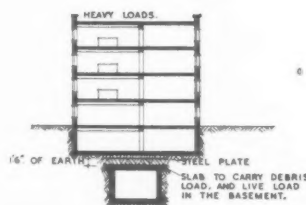
The following relationships between accommodations will be of interest (neglecting for the moment the remark about trench accommodation, which will be dealt with later).

Where the clear height of a room is 8 ft. 4 in. or more, the requirement of 50 cubic feet per person is automatically fulfilled when 6 square feet of floor area per person are provided.

Where the height of a room is less than 8 ft. 4 in. the requirement of floor area per person is  $\frac{50}{h}$  in

which  $h$  ft. is the height of the room. This combines the requirement both for space and for capacity.

As the number of persons to be accommodated in a shelter increases, the smaller becomes the surface per person ; but for the same cubic capacity, this surface area can be increased to a certain extent, by elongating the shelter.



**37** Trenches under heavy storage loads.



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If a shelter is to be sufficient without ventilation and with closed doors, it would require 75 square feet of surface area per person.

Table I gives the maximum number of people to be accommodated\* in rectangular or practically rectangular cells of shelters. The figures in brackets are the required floor areas.

The Table applies to shelters normally with natural ventilation, but which will be provided with artificial ventilation in cases of emergency.

The figure of 6 square feet per person is not to be taken on the areas of any secondary rooms such as corridors, lavatories, first-aid rooms, etc. For the preliminary determination of area required, including that of secondary rooms and walls but excluding first-aid and decontamination rooms, 9 square feet per person should be allowed. For first-aid rooms, where required, an additional 200 square feet, and for decontamination rooms 300 square feet, should be allowed for 500 persons. (See also paragraph 34.)

According to the Code, certain trench or tunnel shelters can be provided without any restriction on volume and surface area, and affording only 3.75 square feet of floor area per person.

Such trenches are required to be open to the air at both ends, and it is important to keep in mind that, if at any time they must be gas-proofed, the number of people accommodated in such shelters will have to be reduced considerably, even with the provision of ventilation and air filtration; and consequently, new shelters will have to be provided. It is considered therefore that only for purely temporary shelters or where limited accommodation makes other shelters impossible, should use be made of the permitted increase in density of occupants.

The following example will illustrate this point. A traverse of a covered trench is 7 ft. 6 in. wide and 25 ft. long, thus providing shelter for 50 people. The cross section is shown in Fig. 38.

The volume is :

$$25 \times (7.5 \times 5 + \frac{3.75^2 \times 3.14}{2}) = 1,492 \text{ cubic feet}$$

= 29 cub. feet per person

The floor area is :

$$25 \times 7.5 = 187.5 \text{ square feet} = 3.75 \text{ square feet per person}$$

and the surface area is :

$$25(7.5 + 2 \times 5 + 7.5 \times \frac{3.14}{2}) = 732 \text{ sq. feet}$$

= 14.7 sq. feet

If at any time gas-proofing should be required then the general requirements will apply and the shelter will afford accommodation for only the

least of the following numbers of people :

$$\frac{1492}{50} = 29 \text{ people}$$

$$\text{or } \frac{187.5}{6} = 31 \text{ people}$$

$$\text{or } \frac{732}{25} = 29 \text{ people}$$

That means that the shelter now constructed for 50 people might in fact serve only 29 when it is most required

(11) *Separation of Trenches.* It is the main intention of the Code to reduce the casualties likely to result from direct hits.

There has been considerable argument on the best way of achieving this result. It has been claimed, on mathematical grounds, that concentration does not affect the number of casualties, because the greater number of people involved in a direct hit when they are concentrated would be compensated by the fewer direct hits. On the

# (11) Limits to Number of Persons and Separation of Shelters

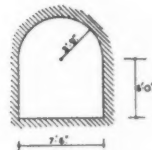
In order to minimize the number of casualties likely to result from a direct hit, shelters should preferably be limited to parties of not more than 50 persons. The distance between the shelters should be not less than 25 feet in any direction, and 40 to 50 feet spacing is preferable where space permits.

TABLE I

Capacities of shelter compartments. "a" ft. long, "b" ft. wide, "h" ft. high. Normal ventilation to be natural but emergency ventilation to be mechanical.

| h      | a/b         |             |             |             |              |              |              |
|--------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|
|        | 1-0         | 1-25        | 1-5         | 2-0         | 3-0          | 4-0          | 5-0          |
| 6' 6"  | (432)<br>56 | (439)<br>57 | (446)<br>58 | (485)<br>63 | (572)<br>75  | (677)<br>88  | (854)<br>101 |
| 7' 0"  | (350)<br>49 | (350)<br>49 | (367)<br>51 | (392)<br>55 | (456)<br>67  | (535)<br>75  | (617)<br>86  |
| 7' 6"  | (394)<br>44 | (294)<br>44 | (301)<br>45 | (328)<br>49 | (387)<br>58  | (455)<br>68  | (528)<br>79  |
| 8' 0"  | (256)<br>41 | (256)<br>41 | (263)<br>42 | (288)<br>46 | (338)<br>54  | (400)<br>64  | (455)<br>73  |
| 8' 4"  | (234)<br>39 | (240)<br>40 | (246)<br>41 | (264)<br>44 | (318)<br>53  | (372)<br>62  | (426)<br>71  |
| 9' 0"  | (276)<br>46 | (276)<br>46 | (288)<br>48 | (306)<br>51 | (366)<br>61  | (432)<br>72  | (498)<br>83  |
| 10' 0" | (336)<br>56 | (342)<br>57 | (354)<br>59 | (384)<br>64 | (450)<br>75  | (534)<br>89  | (612)<br>102 |
| 11' 0" | (408)<br>68 | (414)<br>69 | (426)<br>71 | (462)<br>77 | (546)<br>91  | (702)<br>117 | (789)<br>127 |
| 12' 0" | (492)<br>82 | (498)<br>85 | (510)<br>85 | (552)<br>92 | (654)<br>109 | (788)<br>128 | (882)<br>147 |

\* Where shelter compartments are arranged for a greater number of people the area of floor per person must be increased.



38—Cross section of trench chosen as example—see text.



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a certain limit (110). On the other hand accommodation can be given to 1,420 persons per acre instead of 550 as in Fig. 40, and the overall area becomes 30.7 sq. ft. per person.

There is, of course, the possibility of reducing the number of likely accidents by providing shelter walls of higher standard than that of the usual trench walls (see Trenches, para. 22).

At present, however, it must be realized that a grant given by the Government will not cover any expenses that are incurred solely in increasing the standard of protection beyond that specified in the Code.

The problem becomes different when the available space does not allow 30.7 sq. ft. per person, and where basement accommodation is not available. In such cases, trenches must be nearer together and the number of likely casualties, increased by the reduction of the distance, must be compensated by better quality of the walls.

An ideal material for damping out shockwaves in the ground is gravel. If the earth in which an explosion occurs is separated by means of a layer of gravel from a concrete wall, or other structure, the shock is considerably reduced. Nevertheless, even gravel in conjunction with a concrete wall of reasonable thickness will not withstand an explosion that is within a distance of about 8 ft. If, however, a series of parallel trenches are separated one from another by a barrier of such construction, no explosion would affect more than two trenches, and if the number of people in one group is reduced to 40, the possible casualties will be 80.

The shelter shown in Figs. 44 and 45 is constructed according to such principles.

Shelters of this type can be arranged for 2,420 people per acre, i.e. at the rate of 18 sq. ft. per person. The pill-box system as devised by Arup is also to be recommended where space is scarce (Fig. 46), but with the amended arrangement of communications shown in Fig. 47. This system would give shelter to 2,070 people per acre, i.e. at 21 sq. ft. per person (total area).

Where the densities given here are still insufficient, trenches are to be replaced by totally excavated areas which are to be treated in the same manner as basements (see para. 22).

(12) Where, owing to restriction of the site available, it is necessary to accommodate parties of more than 50 persons, as in large basements, strong dividing walls should be provided between the parties. The maximum number in a party must be limited to 200, and the dividing walls should be provided under expert advice. As a working rule the dividing walls should be not less in thickness than twice the thickness of the floor over the shelter if made in reinforced concrete,† nor less than three times the thickness of the floor over the shelter if made in brickwork or masonry.‡ In no case may the

† The concrete should be of structural quality consisting of not less than 112 lbs. of cement to 2½ cubic feet of fine aggregate and 5 cubic feet of coarse aggregate.

‡ The brickwork or masonry should be built in cement mortar, or cement-lime mortar not weaker than 1 part by volume of cement to 1 part of lime and 6 parts of sand. Existing walls may be utilized, being thickened where required up to the standard given above.

(12) *Separation of basement shelters.*—While in all other respects the Code setting standards for blast and splinters only, avoids the consideration of what might happen in the immediate neighbourhood of a direct hit, the purpose of a division wall is to prevent a neighbouring cell from being affected by a direct hit, even if it occurs very near. (Fig. 48.)

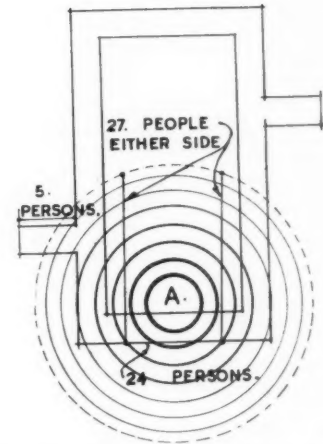
It is suggested in the Code that expert advice should be taken on the construction of such division walls; there are also minimum thicknesses suggested. It can fairly be held that these minimum thicknesses are, in all circumstances, too low.

The necessity of such division walls should, except in the cases mentioned later, be avoided and their use discouraged.

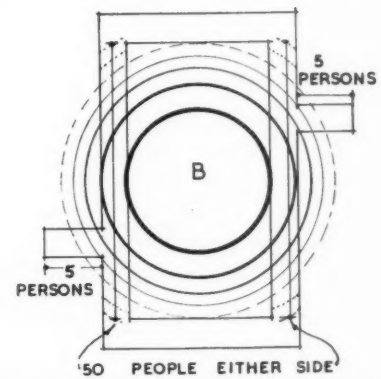
Where, however, they are necessary, the thickness should not be less than 2 ft. 6 in. of reinforced concrete or 3 ft. 9 in. of brickwork.

In order to be effective, the walls will require good and deep foundations and, further, they must be properly anchored at the top, either to the existing floor, if it is strong enough, or to a new ceiling constructed beneath it.

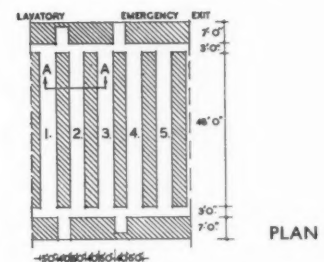
The construction of such division walls is to be recommended particularly where existing basements are of such shape that only short lengths of



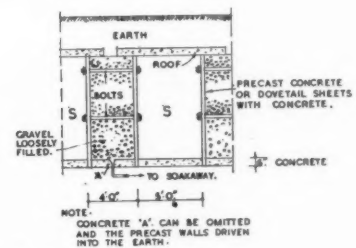
42 83 people may be involved in an explosion.



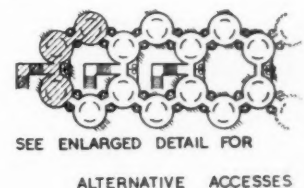
43 110 people may be involved in an explosion.



44 Arrangement of trenches in very confined areas.



45 Section AA in Fig. 44.



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dividing walls be less than 12 in. thick in reinforced concrete, nor less than  $13\frac{1}{2}$  in. thick in brickwork or masonry.

new wall need to be built. In old basements, brick walls of 3 ft. thickness are by no means rare and sometimes, a slight thickening of the wall and a closing of some openings will provide a reasonable division wall. It is not necessary to bond additional brickwork to an existing wall. On the contrary, the existence of an air space is of advantage when the extra thickness is not less than  $13\frac{1}{2}$  in.

Fig. 49 shows a typical case in which reasonable division walls have been obtained. (For entrances, doors, etc., see paragraph 13.)

There is yet another way of dealing with the problem. Although in principle the Code permits groups of up to 200 people in the one compartment or shelter, it will be only in exceptionally high basements (12 ft. clear) that even 125 people can be put into one room without increasing the floor space per person. For the average basement, this number of persons will be still further reduced. It should be remembered that these problems arise only where space is limited, and, therefore, nobody would reasonably increase the required area per person in order to get bigger parties into one cell. Under these circumstances, it will be more reasonable usually to have compartments for only 50 to 70 people.

Where this is the case, it is recommended that walls be provided to confine an explosion to not more than three shelters at the most. (Fig. 50.) This can generally be achieved without difficulty, for an arrangement of two walls, each of  $13\frac{1}{2}$ -in. brickwork or 12-in. reinforced concrete, at a distance apart of not less than 10 ft., is considered sufficient to withstand the explosive effects of most bombs.

If this method is chosen, never more than three cells should be contiguous. (Fig. 52.)

Where more than 70 people (but less than 100) are in a cell, there should be only one other cell adjoining unless a heavy division wall separates them. Such an arrangement can often be made by separating groups of two shelters from others by lavatories, first-aid rooms, etc., which would be occupied only by a very small number of people. (Fig. 53.)

For the design of such systems—see "Arrangement of shelters in basements," paragraph 27.

Care must also be taken where cells are arranged round a central space which itself is not part of the shelter. The walls should then be considered as division walls as an explosion in the central area could affect all surrounding cells. In general, such walls should not be of a less thickness than  $22\frac{1}{2}$  in. of brickwork or 18 in. of reinforced concrete; but in special cases, even greater thicknesses, even up to those mentioned previously for division walls, are advisable. (Fig. 54.)

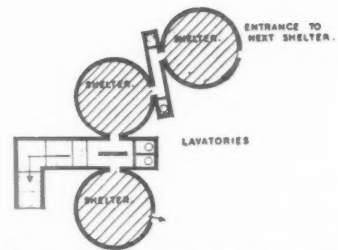
## (13) Access to Shelters

Whatever type of shelter be adopted, it should be so located and boldly marked that access to it is easy, and that both in daylight and after dark all persons can reach their allotted places with a minimum of delay, and in any case within a period of not more than 5 minutes of an alarm being given.

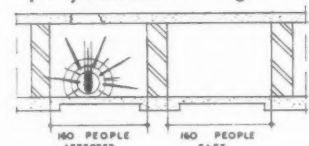
(13) Access to Shelters. Access to basement shelters will usually be from a central staircase or other staircases, either directly to the shelters or through some part which is part of the shelter. (Fig. 55.)

Every access, though itself not part of the shelter, must be of sufficient width to afford free passage to the shelter occupants. Although it is assumed that all persons must be in their respective shelters within 5 minutes of the alarm, there will not necessarily be that period for all to get past any particular point such as the access staircase. Unless tested practically, accesses should be designed to allow free passage to all persons in a period of 2 minutes. (See also paragraph 33.)

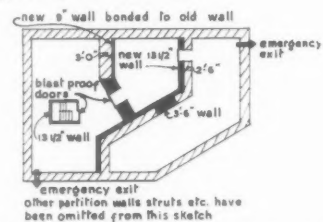
This figure will vary in certain cases; but until some exact data are available, it may be taken as the general rule. An accepted value for the number of persons passing a point in a 2 ft. 6 in. wide



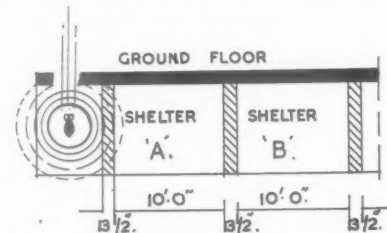
47 Alternative arrangement of communications for system shown in Fig. 46.



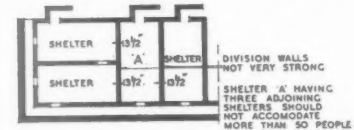
48 Effect of division walls.



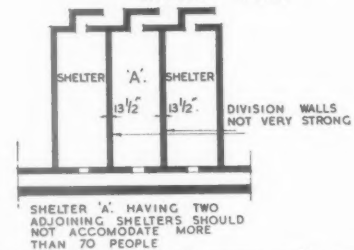
49 Division walls in an existing basement.



50 Shelter B will probably be unaffected.



51 Arrangement of 50-person cells avoiding "division" walls.



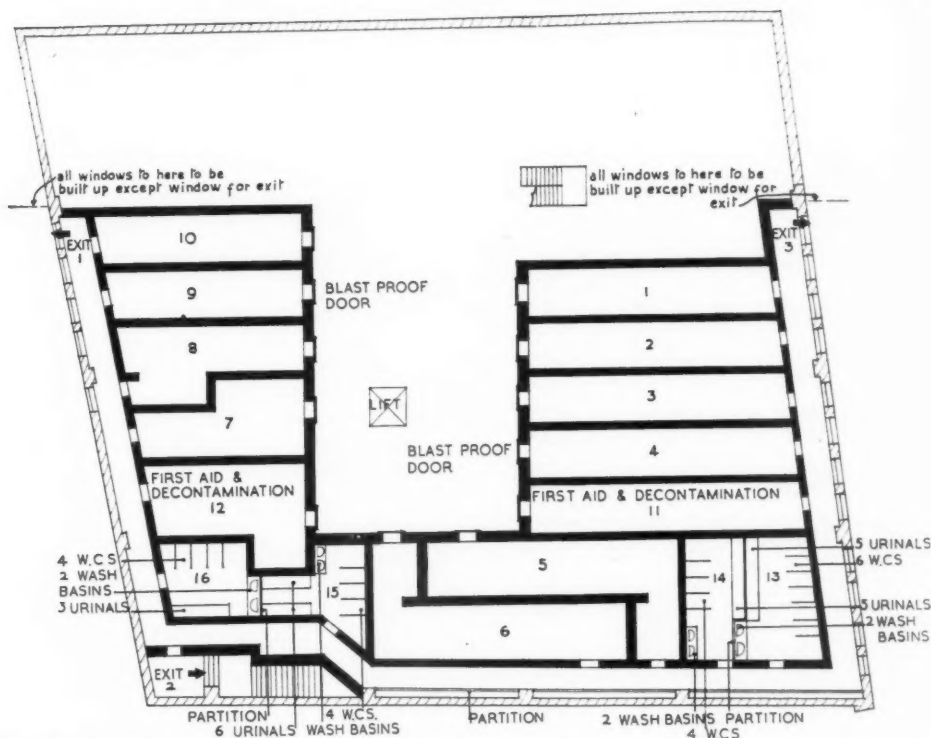
52 Arrangement of 70-person cells avoiding division walls.



shelter "A" with one adjoining shelter must not accommodate more than 100 people

53 Arrangement of shelters for 100 people.





passage is 100 per minute. Thus for 200 people an access 2 ft. 6 in. wide would be sufficient. For 300 people about 4 ft. 6 in. would be needed. Corridors should generally be 6 in. wider than the minimum figures which refer to doors, etc.

The parts which are not to be considered as shelter must be separated from the remainder in such a way that :

- (a) No debris can fall into the shelter.
- (b) No direct blast can enter the shelter.
- (c) If required, at a later date, the separation can be made gas-proof. (Appendix I.)

By complying with the requirements under paragraph (3), this protection will derive automatically, except in the case of the access doors, for which there are two methods of treatment :

(1) The provision of blast-proof doors which are also gas-proof.

(2) The provision of screen walls sheltering the entrances.

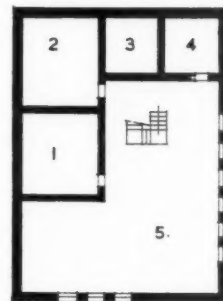
Either the screen walls should be designed to withstand external debris loading or the area outside any door must be strutted in the same manner as the shelter itself for a radius not less than the height of the shelter.

When blast-proof doors are fitted, forced ventilation must also be provided, unless 75 ft. of surface area are available per person. Natural ventilation calls for open entrances and exits. In other words, there is little point in fitting blast-proof doors to a shelter which is to have natural ventilation. However, the provision of artificial ventilation is not a very expensive matter, and if gas-proofing is ever required, artificial ventilation has then to be installed in any case. Further, screen walls occupy valuable space, and may require also provision for the installation of gas-proof doors, at any later date.

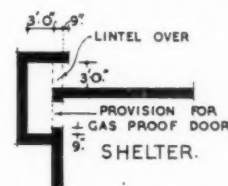
Figs. 56, 57 and 58 show the arrangement of screen walls outside an entrance to a shelter.

The principle to be observed is that openings should never be opposite each other. The thickness of screen walls should be the same as that of the external walls. The arrangement shown in Fig. 56 is doubtlessly the best : but it will, however, often be found impossible to adopt it for lack of

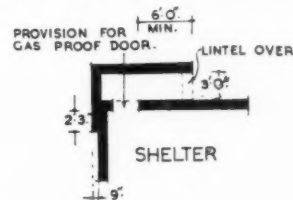
54 Actual example of a basement protected in accordance with the requirements of the Code.



55 Central staircase giving access to shelters.



56 Best arrangement of screen wall.



57 Screen wall for corner entrances.



58 Screen wall to entrance in side of shelter.

space. Of the two other arrangements, that shown in Fig. 57 for a corner is the better. If an entrance cannot be made at the corner, a short inner screen wall (Fig. 58) is recommended in addition.

Sometimes considerations of space will make it essential that the screen walls be inside the shelter. This can be done in the ways shown in Figs. 59 and 60. The entrance in the corner is to be preferred.

In no circumstances is the space between shelter and screen walls to be used as shelter area, nor to be taken into account for the calculation of the necessary shelter space. Where outside screen walls are used a recess of 9 in. is very desirable, in order to accommodate gas-proof doors, whenever required. Every screen wall should be stiffened at its free end against the shelter walls by means of lintels or arches over.

Screen walls can either be carried up to the ceiling, or, in the cases of high basements, be only 6 ft. 6 in. high and covered with a slab capable of withstanding debris load (Fig. 61). The screen walls of a series of shelters can be connected to form a corridor linking the entrance to the basement to all shelters (see Fig. 62). Such a corridor, which is to be protected as part of the shelter, is generally not required in private shelters. An exception, however, is that shown in Fig. 62, where the corridor is the only alternative to having the occupants troop through a number of cells, before reaching their own.

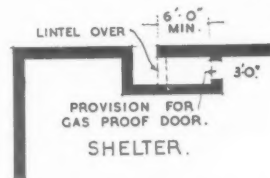
The case of public shelters is different, for the problem of gas-proofing has to be solved at the start. Also, in order to reduce the number of decontamination plants, one such plant might be connected with several shelters, by a corridor, or might even itself form a corridor, so that everyone entering the shelter would pass the decontamination chamber (Fig. 63).

Where a number of cells are provided, it is advisable for every cell to have its own separate entrance. If this can be done, the cells need not communicate directly with each other, but only through the exit accommodation—see paragraph (14).

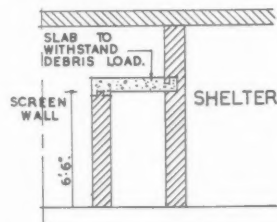
Where cells cannot have their own entrances from non-shelter space, either blast-proof doors or screen walls must be arranged in the same way as for the external walls. This might happen, for example, where the whole of a basement is required for shelter space, and when only one cell can adjoin the staircase, the other cells being reached only through the first.



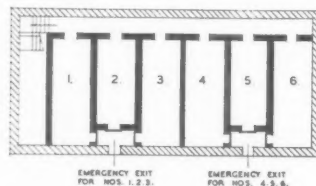
59 Corner entrance with interior screen walls



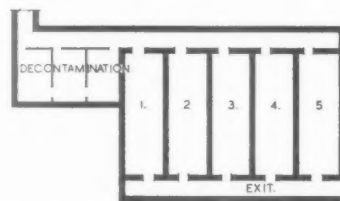
60 Side entrance with interior screen walls.



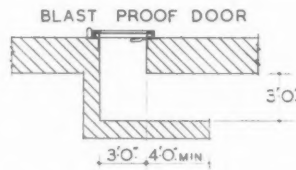
61 Entrance to shelter showing screen wall.



62 Shelters linked by corridor.



63 Use of corridors in public shelters.



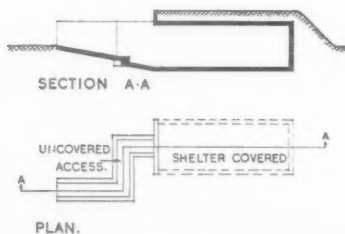
66 Screen wall combined with blast-proof door.



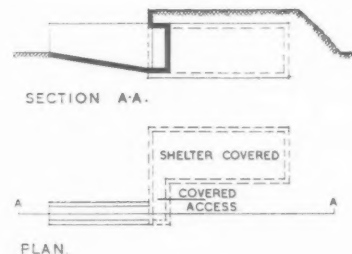
64 Double blast-proof door.



65 Double screen wall.



67 Incorrect type of entrance to a shelter.



68 Correct type of entrance to a shelter.

TEX

(14) In mean entrance shelter each situa the possi outsi

TEXT OF CODE

Division walls of 3 ft. 9 in. brickwork or 2 ft. 6 in. concrete should have either—

(a) Double blast-proof doors (Fig. 64).

(b) Double screen walls (Fig. 65).

(c) One blast-proof door and one screen wall (Fig. 66). The screen walls should be at least of 2 ft. 3 in. thickness in brickwork or 1 ft. 6 in. in reinforced concrete.

Access to trenches will usually be from the outside of buildings, and the main point in this arrangement is that blast cannot strike directly into the main shelters.

Such accesses are generally ramped, but frequently they incorporate stairs. There is a common and serious mistake made in the design of such accesses. It is that of assuming, if the access is curved or cranked on plan, that the entrance is necessarily protected against blast (Fig. 67). Such an entrance can be considered blast-proof only if there is top cover over an appreciable bend or crank before the shelter proper is reached. An angle between the shelter and the access, under cover, is essential (see Figs. 67 and 68). There should be one entrance of 3 ft. width for every 100 people per minute, or of 5 ft. width for not more than 200 people (see paragraph 33).

If the shelters are properly inter-connected they can serve alternatively as emergency exits (see Figs. 40, 41, 69 and 70). [Figs. 69 and 70 are taken from the Code.]

Where trenches have only one entrance, a separate emergency exit must be provided. In general, the principle of having at least two entrances of equal capacity is strongly to be advised.

The sub-division of trench shelters is best done by cranking the line of the shelters (see Figs. 40 and 41). The intervening earth then acts as screen wall. Blast-proof doors are not recommended for trenches, except where reinforced concrete walls of not less than 8 in. have been built, in which case the shelter can hardly be regarded as still belonging to the trench class. It should be treated as a basement shelter (see paragraph 22).

**(14) Exits in an Emergency**

In order to provide an alternative means of exit in case the normal entrance should be blocked, each shelter must have two entrances situated as far as possible from each other. Where a shelter is situated inside a building one of the entrances should, wherever possible, communicate with the outside air.

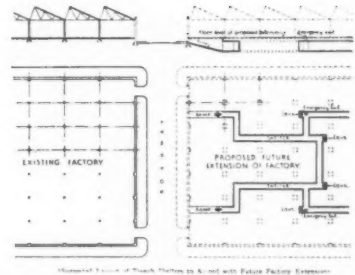
**(14) Emergency Exits.**—Where shelters have several entrances, and when the compartments of such shelters are sufficiently inter-communicating, and when such entrances all lead into the open, at points that are not endangered by any falling debris, entrances can be considered as alternative emergency exits. This will be the case for most outdoor trenches, and where basements are used for public shelters, frequently entrances will be arranged that conform with this condition.

In private basements it must be appreciated that entrances and emergency exits serve two entirely different purposes, and one opening can seldom serve the two purposes.

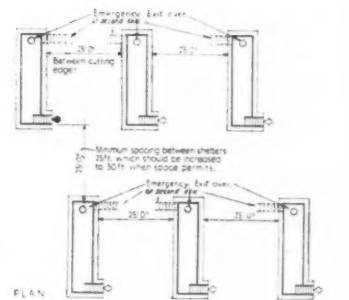
The purpose of an entrance is to afford employees in a building free access from their work to the basement shelter in the least possible time after the alarm has been given.

When the signal "all clear" is given, they go back by the same "entrances," the emergency exit affording escape, preferably directly to the street, if the normal entrance is blocked. The emergency exit must therefore be protected in the same way as the shelter, for a certain distance from the shelter. It will be found that this will sometimes be very difficult, and where an exit cannot be carried through to a safe point, double emergency exits should be provided so that, should one of them be blocked by debris or in any other way, there would still remain the second means of escape.

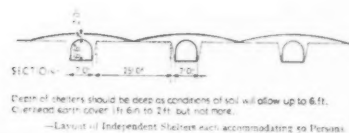
Where several compartments are made in a shelter, they should either have a special exit each



**69** Suggested layout of trench shelters to accord with future factory extensions.



**70** Layout of independent shelters each accommodating 50 persons.



## TEXT OF CODE

or they should be inter-connected. Such inter-connections can best be provided by a corridor joining the different cells and having emergency exits at the ends, or at other points.

This arrangement, shown in the examples in Figs. 54 and 63, has the advantages that:—

(a) the cells need not communicate directly with each other ;

(b) the lavatories can be made accessible through the corridor ;

(c) if an accident occurs, controlled circulation of the people can be maintained.

The ideal emergency exit would be protected for a distance beyond the building line of not less than that given in paragraph (4) 2, i.e. normally for a distance from the building of about half the height to the eaves or parapet above the exit.

For free-standing buildings this requirement can be satisfied by a trench from the basement, as shown in Fig. 71. Such a trench should be protected to a greater degree than is the remainder of the shelter (see paragraph (9)). Under no circumstances should the covering of earth, suggested there, be omitted, even if for that purpose the clear height of the corridor must be reduced. Usually, 6 ft. 6 in. height should be accepted as the minimum ; but in extreme cases even this height may be further reduced. It is better to have a shallow exit properly protected than one affording more headroom but less protection.

For many buildings, surrounded by others, such ideal exits will not be possible, and instead the exits will have to lead on to pavements, yards, loading docks, etc., each of which might, of course, be blocked by debris.

Such exits can often be made possible by a reduction of their internal dimensions. Such a reduced escape, in the form of a vertical shaft of 3 ft. diameter, with a step ladder and a manhole cover on the top capable of being lifted from inside is shown in Fig. 72.

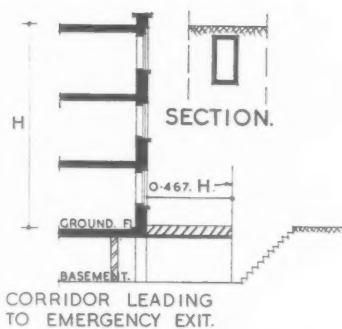
It has also been suggested that shelters should be connected by corridors to an exit, cut through to an adjoining basement. This is of value, however, only if a similar corridor is arranged in the next building, leading from this point to a further exit. In fact, it would be an excellent plan for the owners of different office buildings in the one block, to come to an arrangement for the construction of corridors through all their buildings (see Fig. 73).

Where trenches are made under existing buildings, special exits, similar to those for basement shelters, are to be provided giving direct access to the open air. If in any building such exits cannot be made directly to the open, the exits should be made to those parts that are of the best construction, preferably framed, i.e. of structural steel or reinforced concrete framework. Where necessary, the floor over the exits may be stiffened in the manner suggested for basement shelters (see paragraph 27).

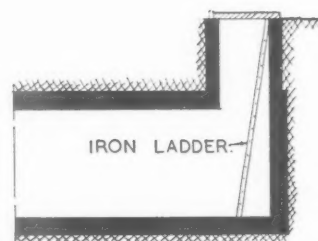
(15) Where any opening into a shelter is above ground level it shall be protected by a screen wall or earth traverse affording not less than the standard lateral protection.

(15) *Screen walls for exits into the open.*—This requirement applies only to shelters opening directly to the open and not to exit corridors, which in themselves afford protection against blast. (See Fig. 74.)

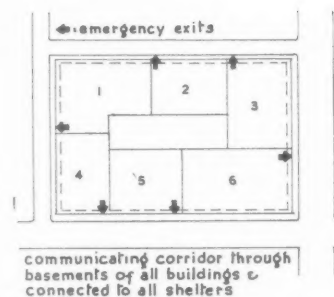
The space between a screen wall opposite a shelter and the shelter, should be either covered or, alternatively, the screen wall should be carried up above the top surface of the required thickness of the shelter roof for a height not less than one-third of the clear distance between the wall and the shelter. If the actual roof to the shelter is of greater thickness than that required, the extra height need not be taken from the actual top surface.



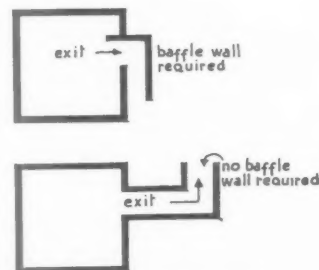
71 Protection of an emergency exit.



72 Emergency exit.



73 Linking of shelters of different buildings by corridors.



74 Screen walls for shelter exits.



## TEXT OF CODE

## (16) Sanitary Accommodation

Sanitary accommodation should be provided close to, and if possible within, the shelter. One closet seat should be provided for 25 persons with subsidiary buckets and urinal facilities. The closet partitions should be carried right up to the ceiling of the shelter.

The need for such screen or baffle walls may arise in the cases of earth covered surface shelters such as that shown in Fig. 75.

(16) *Sanitary accommodation.*—Lavatories may either be connected to existing drainage systems or they may be of the chemical type. From a sanitary point of view, lavatories drained in the ordinary way, are preferable. However, the connections are rather costly and in many cases, as when the sewer is higher than the shelter, pumping would be necessary. There is also the danger of back flow if certain damage to the sewer takes place. The following might be taken as rough guides to the accommodation needed: At least half the closets required should be of the chemical type so that they, at least, will remain in action if the w.c.'s should be put out of commission. Where the sewer is lower than the shelter, and easily reached, the other closets should be connected to this sewer. Where complicated arrangements and pumping would be required for w.c.'s all closets can be of the chemical type. When both types are employed the w.c.'s should always be used in preference to the chemical closets, provided of course that they have not been put out of action.

Supplies of chemicals should be stored in the immediate neighbourhood of chemical closets. Separate lavatories for men and women must be provided; but special division into cubicles within the one group may be omitted in extreme cases.

Separate urinals should be arranged, not only for men, but also for women, for the use of the chemical closets should be reduced as much as possible. The number of urinals should be about the same as that of closets. The urinals may be drained to a soak-away (in the case of trenches) or pumped to the sewer. In the latter case a tank should be provided in addition, so that should the sewer be cut off, the urinals will be usable at least for a few hours.

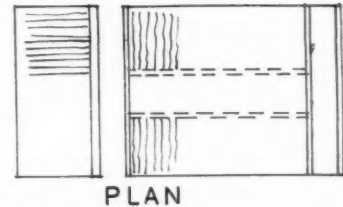
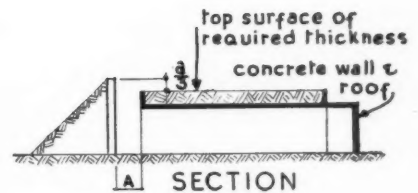
Wash basins are not specifically required; but at least one basin for four closets is to be recommended. Basins may use the same drainage system as the urinals. For accommodation in lavatories see Figs. 76, 77 and 78.

It is suggested that lavatories may be arranged in concentrated groups for as many as 300 people, provided that they remain easily reached from all cells. Concentration simplifies the installation of water and drainage, and for the same reason, where decontamination and first-aid accommodation is required, they, too, are best arranged near the centralized service area. (See para. 34.)

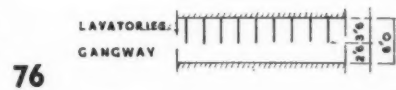
Existing drains very often determine the position of lavatories. Where a corridor is provided, as suggested in paragraph 14, lavatories should open off this corridor. Where no such corridor can be arranged, the fact that too great a circulation of people through the shelter compartments is to be avoided, must be kept in mind in the planning of the lavatories. Where no corridor is available a common anteroom for men and women is required separating the w.c.'s from the shelter.

It might be emphasized here, that the question of hygiene is of very great importance, particularly if people may have to remain for any prolonged period in shelters. With a little care lavatories need not be offensive and certainly any offensiveness should not penetrate to the main shelter.

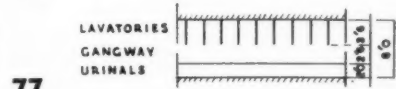
It is not required that lavatories be ventilated but ventilation seems very necessary and local by-laws will presumably ask for it in every community.



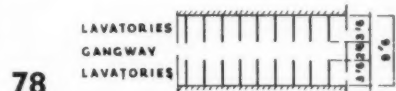
75 Screen walls for surface shelters.



76



77



78

**TEXT OF CODE**

The ventilation must be of the intake type and might be combined with a general system.

A central duct over the corridor can generally be installed without difficulty. The exhaust air would best be discharged above the roof of the building, but it might be permitted to discharge into the street in an emergency, provided that such ventilation, as well as the lavatories, would be used only in times of air raids. The fan should be able to be operated manually if the power supply should fail. Any extract ventilation installed here would have to be replaced by pressure ventilation whenever the shelter is to be made gas-proof. If a shelter is to be ventilated artificially from the start, then the ventilation of lavatories should be part of that system. (See Ventilation, Appendix I.)

**(17) Position of Shelters**

Shelters should be situated below ground level, or at ground-floor level in buildings. Only in exceptional circumstances should shelters be provided on floors above the ground floor of any building, and in such cases the work should only be carried out under expert advice.

(17) *Position of Shelters.* A shelter should never be located on any but the lowest floor, unless all supports below are sufficiently strong and protected. Even in a building with a basement, shelters on the ground floor require particular precautions. These are :

(1) That all dead loads, due to newly-built walls, roofs, etc., as well as the calculated debris load must be properly transmitted through the basement to the foundations, which may be either existing or new.

As a rule, existing foundations need not be strengthened ; but there are exceptions and every case must be investigated carefully, and

(2) That the horizontal loads due to blast, must be resisted. Such loads cannot be clearly determined nor can they be treated in the usual way.

Ordinary frame construction should not be trusted to transmit such loads to the ground ; but continuous walls below of a length not less than twice the height of the basement, may be considered as adequate. (Fig. 79.)

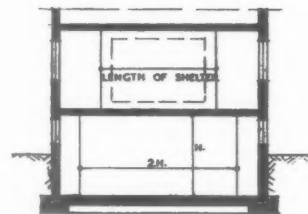
It is evident that a shelter on an upper floor is much more costly than one in the basement. An exception to this rule, however, is that case in which the basement is below ground level on all four sides and in which the ground floor slab is of solid construction, or so stiffened that it would transfer horizontal loads to the surrounding earth. (Fig. 80.) In such an exceptional case, special precautions in the basement to take the horizontal load would be unnecessary ; nevertheless, the vertical loads would have to be carried through to foundations adequately.

Where there are two basements, one above the other, it is recommended that the lower should be used for the air-raid shelter, the exits being protected through the upper basement to the ground floor.

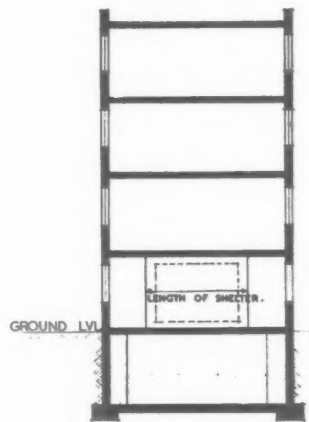
Where circumstances require the shelter to be in the upper basement, the walls must be properly supported and the floor between the basements so stiffened that all horizontal forces could be transferred to the retaining walls.

It will frequently happen that where two basements exist, the lower one, which may not be high, is discarded solely because there is insufficient space to underpin the construction and yet leave enough headroom. (Fig. 81.) In spite of that, the lower basement may be used as the shelter by introducing the strengthening members not below the roof of the lower basement, but below the floor above and by carrying any struts which are required down through the two storeys to their foundations.

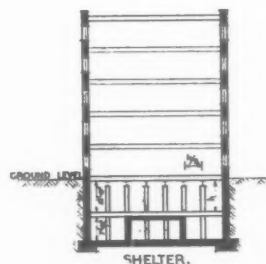
In Fig. 81 a multi-storey building, not of framed construction but presenting this problem, is shown. The clear height of the basement of 12 ft. and that of the sub-basement 7 ft. 6 in. The floor between the basements is not sufficiently strong and joists



**79** Length of walls in basement to be at least twice the basement height.



**80** Solid slab or horizontally strengthened slab at or below ground level may be used to transmit lateral blast pressures on the shelter to the ground.



**81** Ground floor strutted to save headroom in lower basement. Area strutted is the area of the shelter increased on all sides by half the upper basement height.

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to carry the debris load would need to be 12 in. deep so that only 6 ft. 6 in. would be left for the shelter.

It is suggested, therefore, that the ground floor be supported over an area which oversails the shelter by 6 ft. on all sides (this being half the height of the upper basement). Some of the struts may be carried on the walls of the basement shelter. The floor between the basements should be made gas-proof, if it is not so already, and this can be done, for example, by a 2-in. screed on top. For the construction of struts, see paragraph 27.

Only in framed buildings shelters on upper floors may be considered, though they present a number of difficulties. To carry the additional vertical loads and horizontal forces down to the foundations is in all circumstances an extremely expensive job and each case must be dealt with on its merits.

(18) 2. HOW THE REQUIRED  
SHELTER MAY BE OBTAINED

General considerations governing the choice of shelters — shelters outside buildings — shelters within buildings — general requirements for the layout and construction of shelters — provision of shelters in special types of building.

GENERAL CONSIDERATIONS  
GOVERNING THE CHOICE OF  
SHELTERS

The following notes have been prepared to suggest reasonable methods of approach to the problem of satisfying the standard requirements laid down in the first part of this Code.

No two factories or commercial buildings are alike; they differ both in location, in structural design, and in layout and equipment; it is not possible, therefore, to say that any one particular method of protection would prove the best in all cases.

(19) *Expert Advice*

Each case must be treated individually, and it cannot be too strongly emphasized that advice on the best method of treatment should be sought from engineers or architects qualified for such work. When firms have no engineers or architects in their employ the names of suitable experts may be obtained from the well-known professional institutions.

(18) *General references to Types of Shelters.*

(19) *Expert advice.* It is here considered necessary that it should be stressed once again that these general explanations and suggestions must in no way over-ride the expert advice which, it may be assumed, will be based on considerations of the peculiarities and special problems of the individual case. Generalizations are always dangerous and particularly generalizations on matters that cannot really be generalized. It must, therefore, be appreciated that many of the solutions put forward to some of the problems are merely suggestions showing certain ways in which certain difficulties may be overcome.

The whole purpose of this review is that it should form a basis which expert architects or engineers and the authorities might use in achieving the results at which the Code aims.

The question of expert advice is discussed again in Appendix VIII.

(20) Several types of building are illustrated to show how suitable protection for the personnel employed in them can be obtained, but before proceeding with this study there are certain generalizations that may be made irrespective of the type of building considered.

(20) *Shelters for different buildings.* The advantages of basement shelters are:—

(1) Some protection against a direct hit. A general purpose bomb may hit a building, explode in one of the upper storeys and not affect people in the shelter. This is especially so in the case of framed buildings and still more so in framed buildings which project beyond the shelter on all sides. The building then affords partial protection against general purpose bombs falling obliquely.

## TEXT OF CODE

## Methods of Protection

There are two general methods available for the protection of personnel:

(1) By the provision of isolated shelters above or below ground, trench shelters, or tunnel shelters outside the buildings; or

(2) By providing shelters within the building, for which there are various alternatives:

(a) Trenches or tunnels may be constructed beneath the lowest floor of the building; or

(b) Existing basements may be adapted to provide shelters. The roof or ceilings over them should be made to afford the standard of vertical protection indicated in Part I and, where necessary, must be strengthened to support the debris of the structure above in the event of a collapse; or

(c) Existing rooms on the ground floor may be adapted to provide shelters. The walls should be made to afford the standards of protection indicated in Part I, and the roof or ceilings over them should also afford the standard of protection indicated in Part I, and, where necessary, must be strengthened to support the debris of the structure above in the event of collapse; or

(d) Shelters may be specially built within the buildings or "lean-to's" may be erected against a wall of the building.

(2) The possibility of better sanitary and other accommodation.

The advantages of trench shelters are:—

- (1) Lower price.
- (2) Better arrangement of exits.
- (3) Generally better inter-communication.

The advantages of both can be combined in some cases, namely, by the digging of trenches under basements; but this arrangement is applicable only where the existing foundations permit it.

Shelters in ground floors have no advantages over those in basements. They must, however, be taken into consideration where there are no basements or where the water level is so near the surface that underground trenches could not be constructed. In no circumstances should shelters be provided below ground water level, even if they are protected by such means as tanking or waterproof concrete. (Fig. 82.)

There is always the possibility of damage to the tanking or cracking of the concrete due to a nearby explosion or to settlement.

As a general rule the following will be the types of shelters for different buildings; but these examples are merely guides and in the individual case, quite a different choice may be justified.

1. Office buildings with more than 200 occupants (standing on ordinary foundations). (Figs. 83 and 84.) Basement shelters, well protected against falling debris.

The floor of the basement may need to be lowered if there is insufficient height. It may be taken down to within 6 in. of the foundation level. The ground floor should be used only where no basement exists.

2. Office buildings with less than 200 occupants. (standing on ordinary foundations). (Fig. 85.)

As for Case 1.

Where two or three such offices adjoin each other and where one is of much better construction than the others (e.g. it may be framed) it is advisable, by arrangement between the owners, to concentrate the shelters for the whole group of buildings in the basement of that one building. Direct access from each building must be provided without people having to enter any street, and the shelter must be within 5 minutes' reach of every point which it serves. Access may be through the adjoining basements or through underground corridors. The same principle can be adopted where, out of a group of office buildings, only one is provided with a basement.

3. Office buildings (standing on piles or on foundations 6 ft. or more deep). (Figs. 86 and 87.)

Whether there is a basement or not, trenches under the building should be considered.

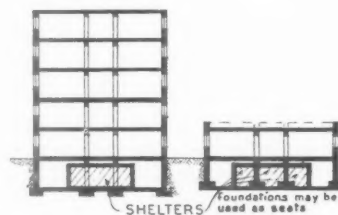
4. Office buildings in spacious grounds. (Fig. 88.)

Such buildings do not usually have adequate basements. Trenches are recommended, but except for the communication corridor they should not be nearer to the building itself than  $0.465 h$  ( $h$  being the height of the building).

A communication corridor allowing people to reach the shelter from the building without going into the open is desirable, but not essential. The corridor would not be considered as part of the shelter.

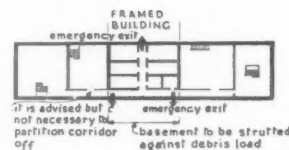


82 Shelters below ground water level.

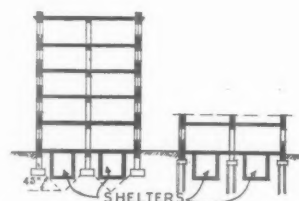


83

84 Basement floor lowered to increase headroom.

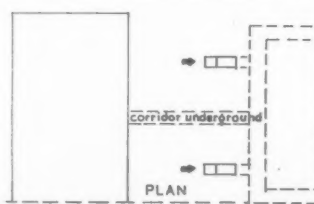
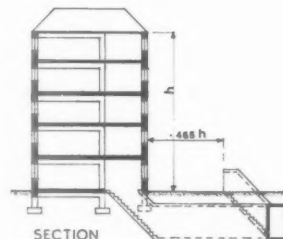


85 Shelters for several adjoining buildings concentrated in one framed structure.



86 Trenches below buildings on deep foundations.

87 Trenches below buildings on piles.



88 Office building in spacious grounds.



5. \* *Individual houses with large gardens.* (Figs. 89 and 90.)

A shelter, sunk partly or wholly into the ground. If only partly sunk, the projecting part has to be covered sufficiently with earth. Full embedding into the earth is recommended, where possible. It is also suggested that the inhabitants of several houses should, by agreement, provide a common trench shelter. Such shelters should be kept as far away from the houses as possible and definitely further than half of the height of the houses. (Fig. 91.)

6. \* *Individual houses with small gardens (yards).* (Fig. 92.)

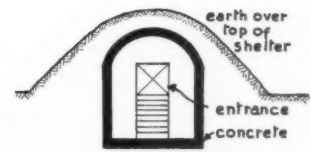
Provision for this group of houses is generally made by the steel shelters distributed by the Government. These shelters should be sunk into the yard, and for that purpose paving may be taken up where necessary. Particularly where such shelters adjoin the houses, the proper thickness of earth on top of the shelter must be observed.

7. \* *Individual houses with basements.* (Fig. 93.)

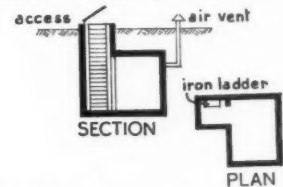
A shelter under the garden similar to that described under No. 5 is preferable, but where that is impossible, a basement room or basement rooms can be adopted. The construction of such houses is often so poor that the difficulties and costs of strengthening are very high. Kitchens should not be used for shelters owing to the trouble which may arise from the service pipes.

8. \* *Flats with brick or masonry bearing walls.* (Fig. 94.)

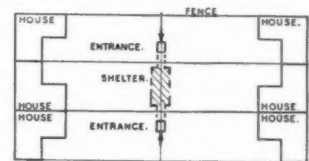
Such flats usually have no basement except the



89 Concrete shelter for individual houses partly sunk below ground level.



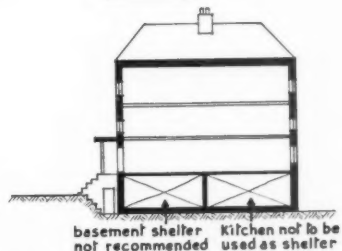
90 Individual shelters—wholly buried.



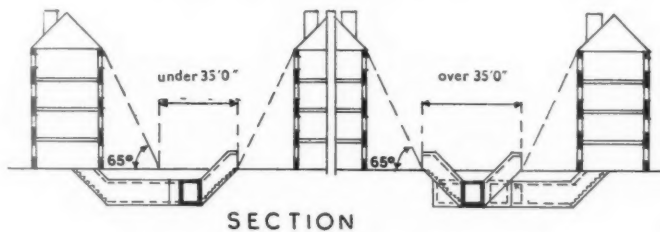
91 Common shelter for six houses.



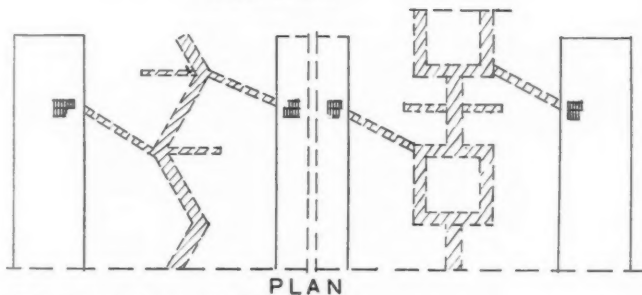
92



93 Shelter in private house with basement.



SECTION



PLAN

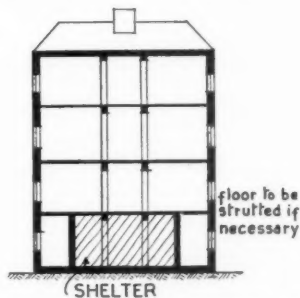
94 Trench shelters for blocks of flats

boiler house which should never be used as shelter. As a rule trenches are to be recommended and usually space can be found between the blocks. The suggested distance from buildings should be observed, and where that is impossible, particular safeguarding of the vulnerable parts is necessary. Covered corridors leading to the blocks are particularly advisable but they will not form part of the shelter.

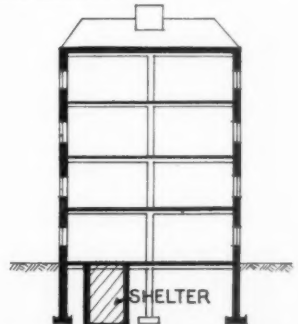
9. \* *Flats of skeleton frame construction.* (Figs. 95 and 96.)

If there is no basement available, the shelters recommended for No. 8 may also be used here. There might alternatively be a possibility of using part of the ground floor, and to provide the necessary overhead and lateral protection. Where the skeleton frame is founded on piles or particularly deep foundations (more than 6 ft.), trenches

\* Strictly speaking, the Code does not refer to this group.



95 Ground floor shelter for flats of skeleton frame construction.



96 Internal trench shelter for flats having deep foundations.

under the building between the foundations should be considered. Such trenches may often be reached from the entrance halls, but should have their emergency exits outside the buildings.

10. *Warehouses with bearing walls of brickwork or masonry.* (Fig. 97.)

There is generally so little space in the immediate neighbourhood of warehouses that basements must be adopted. Attention must be given to heavy loads, which may make the greatest part of the basement impractical. An area having no heavy machinery or stores above should be selected. Loads on upper floors might even be moved to other positions to afford the necessary space below. Where this is impossible, and the shelter must be made under heavy loads, trenches under the basement or ground floor are required even if underpinning of existing walls or columns is involved. The trenches should have sufficient cover of earth. (Fig. 98.)

11. *Warehouses with skeleton frames and solid floors.* (Flat slab construction, if in accordance with the Code of Practice of the Building Research Board, may be considered as skeleton construction.) (Fig. 99.)

A trench under the basement, as described for group 10, is useful, but if its construction would cause difficulties, a basement shelter can be used provided it has sufficient strength to carry the overhead and debris loads.

12. *Multi-storey factories with light plant.*

They are to be dealt with as office buildings of similar construction to 2, 3 and 4, but where there are extensive grounds, trenches may be preferable.

Where there is no basement and the provision of a trench under the ground floor is possible, then it is definitely the most satisfactory construction, particularly in framed buildings.

13. *Multi-storey factories with heavy plant.* (Fig. 100.)

Where the grounds permit, trenches are preferable; but where no grounds are available the shelter should be as for No. 10 and No. 11.

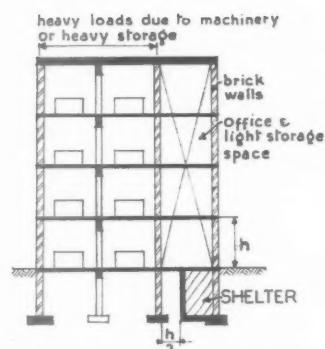
14. *Single-storey Warehouses and Factories* (Fig. 101).

Trenches can be arranged inside or outside the building. Those inside are most satisfactory, although more costly. The amount of debris falling is small, generally only the roof and possibly some shafting, and if the trench is originally constructed to carry stored goods or plant on the floor above, the extra debris load can often be neglected.

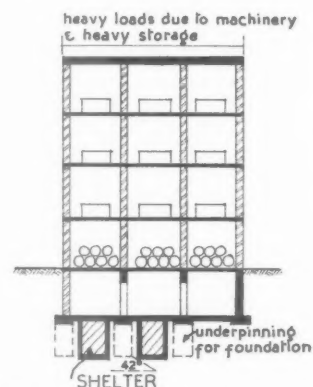
15. *Restaurants, Cinemas, Theatres* (Figs. 102, 103, 104, 105).

The Civil Defence Bill does not apply to the provision of shelters in such buildings (see section 72 (4)), but nevertheless shelters will be necessary in such buildings in towns where performances are allowed and should be provided in spite of the lack of legal responsibility or financial arrangements. It will usually be too difficult to provide adequate accommodation in basements, and no doubt arrangements could be made with local authorities for accommodation in public shelters. Any basements which do exist should be utilized, and in such cases as those in which a restaurant, for example, forms part of an office or similar building, it is important that casual and permanent occupants should be kept separate, particularly in view of a possible use of gas, for the reasons:

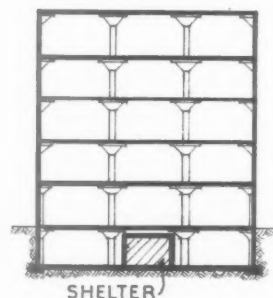
(a) That casual occupants, having come in from the streets, may require decontamination services,



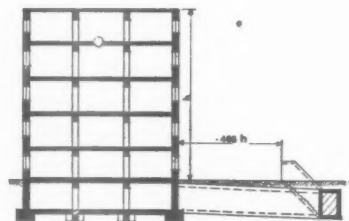
97 Shelter in basement of warehouse.



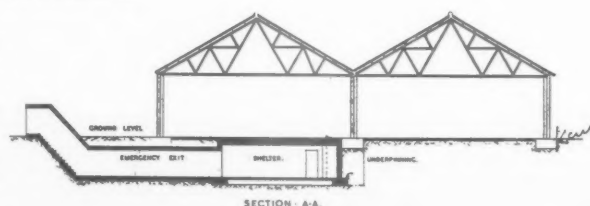
98 Trenches under warehouses.



99 Shelter in skeleton frame warehouse. [Flat slab construction may be regarded as "framed."]



100 Trench shelters for multi-storey factories.



whereas those permanently occupied in the building will not have been exposed to gas; and

(b) That permanent occupants, familiar with the building, will be trained in reaching their portion of the shelter in the most efficient way, and that that way would be upset by confusion with casual occupants. Arrangements must be made for the organization and controlled movement of casual occupants by some of the permanent occupants trained for that purpose.

Where the foundations are deep enough a basement shelter may be created, even if it does not already exist. Kitchens should always be avoided, and also other areas where many service pipes exist.

As basements of restaurant buildings will generally be found to present special difficulties, the provision of corridors leading to neighbouring premises, and the arrangements of shelters there, should be kept in mind.

In cinemas and theatres the provision of a new basement under the auditorium is quite often possible, without undue interference with the use of the building. Any existing ventilation ducts must be avoided, and the possible debris load, although often small, should never be taken as less than 200 lb. per sq. ft. Many cinemas and theatres have their own parking places, and accommodation might be possible under such parking places in the form of new basements. There will rarely be enough space for trenches. These buildings are in the same group, legally, as those given in No. 15, and reference should be made to the introductory remarks there.

#### 16. Hotels (Fig. 106).

Hotels can generally be dealt with in the same way as office buildings. Additional complications arise in big hotels from the fact that the basements are usually occupied to a great extent by kitchens and other service rooms which, apart from their importance for the running of the hotel, are very unsuitable for shelters.

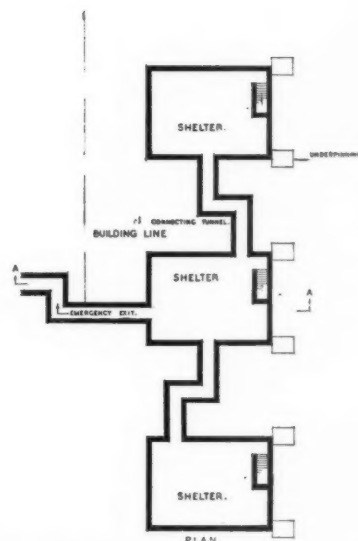
Any portion of a basement not so occupied might be used or arrangements may be made with adjoining owners (Fig. 102).

If both these possibilities are excluded, or if they give protection to only a limited number of people, a room or rooms on the ground floor should be adopted, but communications with parts of the basement used for the same purpose should be afforded.

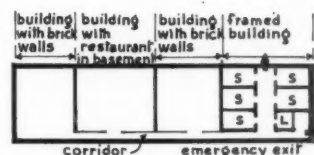
#### 17. Emporiums and Large Shop Buildings.

As a rule, these buildings have extensive basements, part of which may be adopted easily to shelter accommodation, particularly in the case of framed buildings.

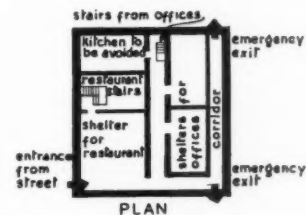
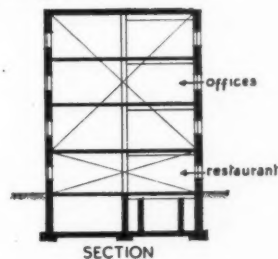
Again, the difficulty of dealing with casual occupants arises, and this difficulty may possibly be overcome in the same manner as that suggested for buildings of class 15. The requirements for shelters for employees or permanent occupants must in any case be satisfied. The local authorities may, however, regard casual occupants as people who would normally be out on the streets and for whom, therefore, public shelter accommodation would be required, and they may even, for that purpose, designate and acquire parts of the building not required for the permanent occupants.



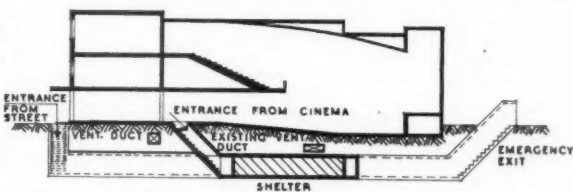
101 Single storey warehouse or factory, floor heavily loaded. See section on page 948.



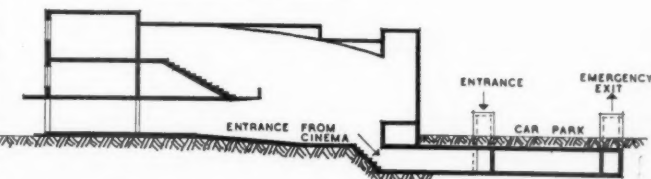
102 Shelter for restaurant in adjoining building.



103 Shelter for restaurant in basement.



104 Shelter under cinema.



105 Shelter under Cinema Car Park.

18. *Public shelters.* (Figs. 107, 108 and 109.)

Public shelters can be arranged in the basements, or other parts of suitable buildings. The following considerations will influence the choice of a shelter site :—

(a) *Locality.*—A shelter should be readily accessible to every person it is to accommodate.

(b) *Standard of construction.*—Well-built framed buildings will be preferred.

(c) *Height of rooms.*—The most suitable height for public shelters, which will most frequently have ventilation systems, is 8 ft. 4 in. in the clear.

(d) *Possibility of sub-division and freedom of layout of proper entrances and exits.*

Shelters can also be arranged under private and public lands.

Under open spaces, where abundant room is provided, shelters may take the form of trenches. Where a greater number of people are to be accommodated per acre than trenches will allow, underground shelters of the basement type will be required and these might be used in peace time as garages.

Where the ground water level permits, and the density requires it, a shelter may be of two or even more storeys.

It is important that the requirements of the Civil Defence Bill and of the Code relating to the following matters are observed.

(a) *Accessibility.*

(b) *Capacity of entrances and exits.*

(c) *Sub-division into compartments or cells.*

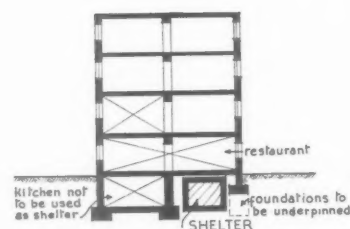
See Appendix VII.

19. *Schools.* As children are to be evacuated from densely populated districts, it can be assumed that sufficient garden area will be available for trenches for other schools and the provision of trenches seems the best form of protection under the Code.

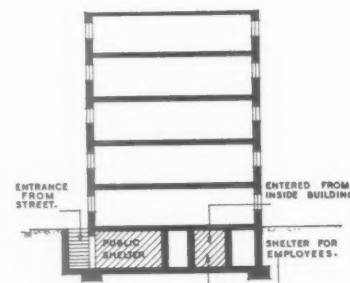
20. *Hospitals.* See special notes made later in connection with the "Emergency Medical Services—Memorandum No. 1—Ministry of Health."

(to be continued)

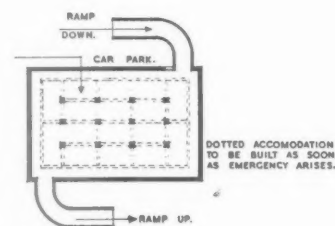
THE REMAINING SECTIONS  
OF THE CODE AND OTHER  
A.R.P. PUBLICATIONS WILL  
BE DEALT WITH IN NEXT  
WEEK'S ISSUE.



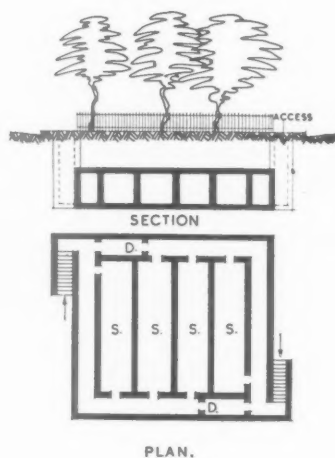
106 Shelter under hotel.



107



108



109