

**A
•
R
•
P
•**

**BOOKLET
No. 3**



**HOUSEHOLD
SERIES**

MAKE YOUR HOME YOUR AIR RAID SHELTER

Published by Authority of
Hon. I. A. MACKENZIE, K.C., M.P.,
Minister of Pensions and National Health

Issued under Direction of
Hon. R. J. MANION, M.C., M.D.,
Director of Civil Air Raid Precautions

OTTAWA, CANADA

Your Air Raid Warden Is:

.....

.....

Telephone No.

The Warden's Post in Your Sector is at

.....

Telephone No.

**EVERY ADULT MEMBER OF YOUR
HOUSEHOLD SHOULD READ
THIS BOOK**

OTTAWA

Edmond Cloutier,

Printer to the King's Most Excellent Majesty.

FOREWORD

»

In many respects, Canada's air raid problem is very different from that of Britain.

The enemy has air bases within a hundred miles of the British Isles and from these, hostile aircraft, singly or in great numbers, can attack with full loads of heavy bombs. What is more, these aircraft can return to their bases, take on another load of bombs and attack a second or third time within the space of a few hours. Britain has suffered furious and prolonged air attacks in which high explosive and incendiary bombs have literally rained down from the skies.

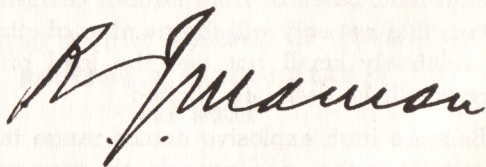
For the time being, at least, nothing even approaching attacks of this kind is likely to happen in Canada. Enemy planes attacking this country will have to operate from distant land bases or from aircraft carriers at sea. This means that not only will the number of attacking planes be relatively small but that the load of bombs each carries will be definitely limited.

Because high explosive bombs range in weight from fifty to three thousand pounds, an enemy plane, forced to fly a long distance to reach its objective, can carry only a few, and each of these, while devastating, is effective only within a limited range of where it falls. On

the other hand, a single enemy raider can carry as many as two thousand small incendiary bombs (even though it must fly a great distance) and can leave a trail of fire over a wide area if the bombs are not dealt with effectively as they fall.

Because of this and for other more technical reasons that need not be discussed in detail here, the likelihood of frequent or prolonged large scale raids by enemy aircraft on Canada appears to be extremely remote. Instead, it seems relatively certain that, until such time as the enemy gains a foothold in North America, we may expect only sporadic raids by small numbers of planes in which a vastly greater proportion of incendiary bombs are likely to be used than either high explosive or gas bombs.

Nevertheless, the unexpected can happen—as the attack on Pearl Harbour so forcefully demonstrated—and we, in Canada, cannot risk being unprepared.



Director of Civil Air Raid Precautions.

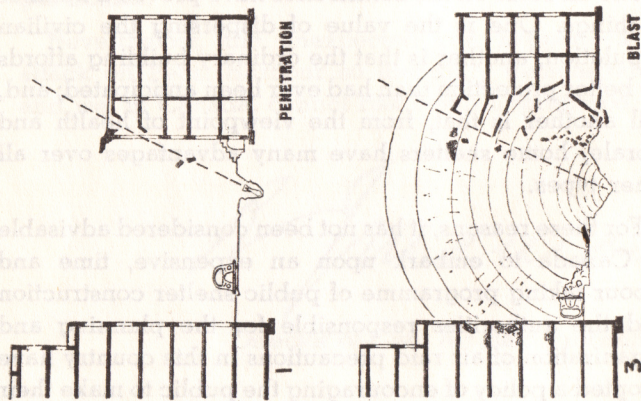
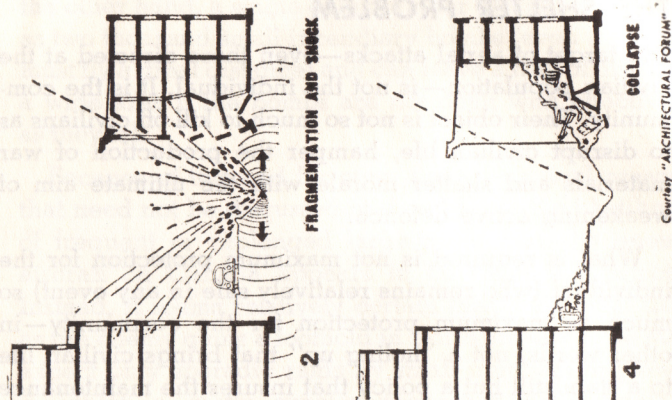
THE SHELTER PROBLEM

The target of aerial attacks—even those directed at the civilian population—is not the individual. It is the community. Their object is not so much to kill off civilians as to disrupt civilian life, hamper the production of war materials and shatter morale with the ultimate aim of weakening active defence.

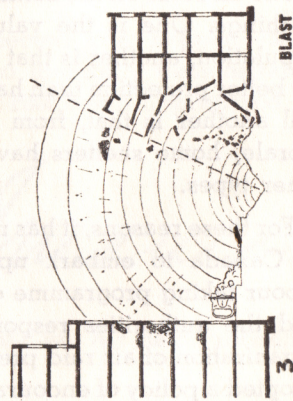
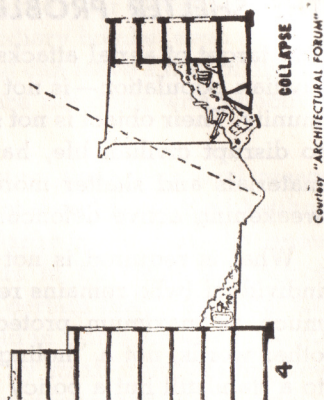
What is required is not maximum protection for the individual (who remains relatively safe in any event) so much as maximum protection for the community—in other words, not a "holing up" that brings civilian life to a standstill but a policy that insures the maintenance of normal conditions in so far as this is possible.

The air raids on the British Isles have proved a number of things. One is the value of dispersing the civilian population; another is that the ordinary building affords far better protection than had ever been anticipated; and, still another is that, from the viewpoint of health and morale, home shelters have many advantages over all other types.

For these reasons, it has not been considered advisable in Canada to embark upon an expensive, time and labour taking programme of public shelter construction and the authorities responsible for the planning and organization of air raid precautions in this country have adopted a policy of encouraging the public to make their own homes their air raid shelters.



6



Courtesy "ARCHITECTURAL FORUM"

Facts About High Explosive Bombs

To understand the problem of air raid shelters one must know something about high explosive bombs.

When a high explosive bomb detonates, anything very close to the explosion is likely to be destroyed or seriously damaged and any building that suffers a direct hit or a "near hit" is almost certain to collapse wholly or partly.

A graphic idea of what actually happens may be gained from the sketches on the opposite page.

Fortunately, the chances of any particular building suffering a direct hit are extremely remote. However, exploding bombs present other hazards which, while less spectacular, cause a vastly greater number of casualties than direct hits. Such hazards are those from bomb blast, flying bomb fragments, shattered glass and falling debris.

The blast of an exploding bomb can shatter unprotected windows a considerable distance away over a wide area and flying fragments of glass can be very dangerous, even deadly. Flying bomb splinters can kill at a distance of half a mile if nothing intervenes to stop them. Falling debris can kill or injure those unfortunate enough to be caught by it.

On the other hand, the ordinary house or building affords a great deal of protection not only against the blast and flying fragments of a bursting bomb but against such hazards as machine-gun fire, fragments of anti-aircraft shells, flying glass and falling debris. And a house or building can easily be made to afford almost complete protection from such dangers.

7

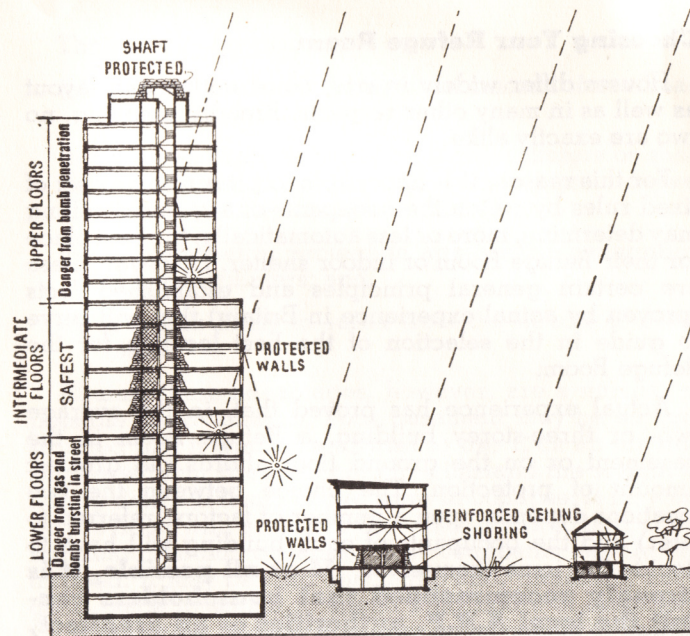
SHELTER AT HOME

The first reaction to the prospect of aerial bombardment is a desire to seek shelter, that is, protective covering from the death that rains from the sky. Natural enough, this instinct is also a sound one. Protection even so rudimentary as that afforded by a doorway will reduce the probability of injury from scattered bombs by 60 percent as compared with complete exposure. Inside most buildings the danger is still less, while some structures reduce it almost to the vanishing point.

The natural inclination of most people is to seek shelter in places familiar to them, such as their own homes. This is a sound instinct too, if some protection can be found against the possible collapse of walls and ceilings.

Shelter at home allows you to sleep at night in reasonable security in the warmth and comfort of your own house. It also provides handy cover in the event of day-time raids.

A direct hit cannot be guarded against in any building, but the risk of a direct hit is extremely small compared with that of a bomb bursting near enough to damage or demolish it. Protection can be obtained in a house even if a bomb demolishes most of it. The walls, floors and roof of an ordinary house provide much protection against bomb blast and splinters. The idea of a home shelter is to make use of this protection and to add safeguards against other effects of bursting bombs.



Courtesy "ARCHITECTURAL FORUM"

The sketches above indicate the relative safety of space within various types of buildings. In a tall building, precautions against direct hits on the sides and top must be taken as well as against blast and splinters from bombs landing in nearby open spaces. In such buildings the intermediate floors provide the best shelter. In smaller buildings and private dwellings a Refuge Room on the ground floor or in the basement or cellar, properly located and prepared, provides the best shelter.

Choosing Your Refuge Room

Houses differ widely in size, construction and layout as well as in many other respects. Broadly speaking, no two are exactly alike.

For this reason, it is impossible to prescribe any set of fixed rules by which the occupants of any one dwelling may determine, more or less automatically, the best place for their Refuge Room or indoor shelter. However, there are certain general principles and established facts (proven by actual experience in Britain) that will serve to guide in the selection of the best location for the Refuge Room.

Actual experience has proved that, in the average two- or three-storey building, a Refuge Room in the basement or on the ground floor affords the greatest amount of protection. The choice between the two locations depends upon a number of factors (referred to later) and the occupants of each building will have to decide the issue themselves. **If at all possible, it is strongly recommended that householders consult the local A.R.P. authorities or an architect, engineer or competent builder in regard to the selection and preparation of their home shelters.** The Engineering Institute of Canada has organized advisory committees of experts in various centres throughout Canada to co-operate with the A.R.P. authorities in air raid shelter problems and their assistance may be sought through the local A.R.P. organization.

In the average well-constructed house which has a soundly built foundation of masonry or concrete, the basement or cellar, having at least one exit to the outside, would appear to be the best location for a Refuge Room.

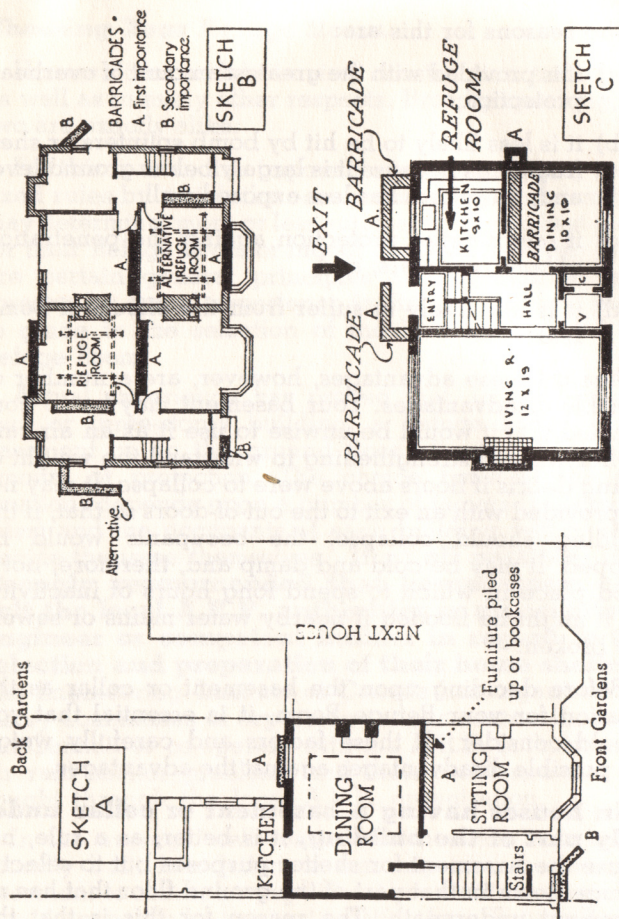
The reasons for this are:

- (a) it is provided with the greatest amount of overhead protection;
- (b) it is less likely to be hit by bomb splinters or shell fragments because it is largely below ground level and, therefore, has less exposed wall;
- (c) it offers better protection against the penetration of bomb splinters; and,
- (d) it is less likely to suffer from the effects of bomb blast.

Against these advantages, however, are a number of possible disadvantages. Your basement may be so constructed that it would be unwise to use it as an air raid shelter without strengthening to withstand the weight of falling debris if floors above were to collapse. It may not be provided with an exit to the out-of-doors so that, if the building should collapse, the occupants would be trapped. It may be cold and damp and, therefore, not a good place in which to spend long hours of inactivity. Or it might be flooded if nearby water mains or sewers are broken.

Before deciding upon the basement or cellar as the location for your Refuge Room, it is essential that you should consider all these factors and carefully weigh the possible disadvantages against the advantages.

In houses having a basement or cellar under only part of the building, it is better, as a rule, not to use the basement for shelter purposes but to select a Refuge Room in that part of the ground floor that has no basement underneath. The reason for this is that the



extra protection afforded by the basement is more than offset by the risk of the occupants being trapped in the building without means of exit should it collapse.

If the basement is unsuitable or the building has no basement, the best location for a Refuge Room or indoor shelter will be a space on the ground floor. You should choose the space with the least amount of exposed (outer) wall and the fewest windows because, to do so, will greatly simplify the problems of strengthening and adding other protection to your Refuge Room. If the space chosen is immediately above a cellar or basement, the floor of the Refuge Room should have adequate timber support under it which should bear on the basement floor below.

On the ground floor it is advisable to select a space at the back of the house (such as the pantry or kitchen) or a room adjacent to a narrow alley-way (which will receive added protection from the next building or wall) in preference to a room facing the street or a large open space.

The sketches on the opposite page will give you some idea of the best locations.

No matter where you decide to locate your Refuge Room choose a small or narrow space, room or hallway in preference to a room with a large expanse of ceiling. A small or narrow room or a hallway will afford much better protection against falling debris if the building should collapse. If a large room is chosen, it is more than likely that you will have to provide some extra support for the ceiling to ensure that it will withstand the weight of falling debris if the upper storeys collapse.

If you live in a small apartment house, a duplex or suite of rooms situated above the ground level, you should arrange with your neighbours or the owner of the building to use some ground floor or basement space as your shelter because the problems of adequate protection above the ground floor are great except in large buildings. A wise plan is to get together with some of the other occupants of the building and arrange for a "community" shelter in the safest part.

If you live in a frame, stucco or brick-veneer house the problem of providing adequate shelter will be considerably more difficult, particularly if the building lacks a well constructed basement. It may be necessary for you to reinforce the walls and ceilings with revetments or barricades and supports or to construct a special indoor shelter.

**Make certain that your
Air Raid Warden knows
the exact location of
the Refuge Room within
your building and those
who are likely to occupy
it during an air raid.**

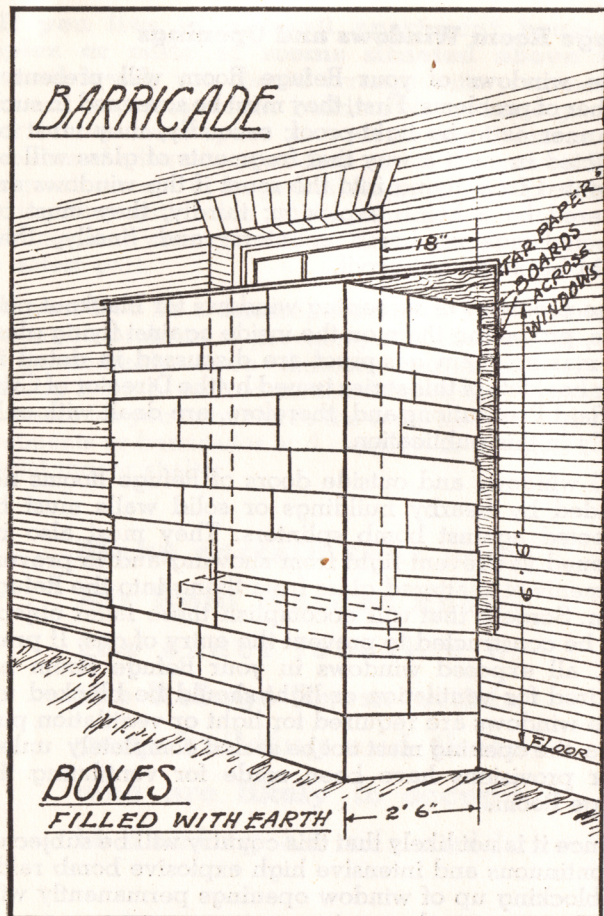
Refuge Room Windows and Openings

The windows of your Refuge Room will present a number of problems. First, they must be screened in such a manner as to be light-proof; secondly, they must be protected in such a way that fragments of glass will be prevented from flying into the room if the windows are shattered by a bomb explosion; thirdly, they must be protected against bomb splinters; and finally, they should be made gas-proof.

The problems of screening windows for blackout purposes, protecting them on the inside against flying glass and making them gas-proof are discussed in detail in other booklets of this series issued by the Director of Civil Air Raid Precautions and, therefore, are dealt with only briefly in this publication.

All windows and outside doors of Refuge Rooms not shielded by nearby buildings or solid walls must be protected against bomb splinters. They must also be screened to prevent light from showing and to prevent fragments of shattered glass from flying into the Refuge Room. Screens that will accomplish these latter objects may be constructed to prevent the entry of gas. If practical, all exposed windows in your Refuge Room not required for ventilation or light should be blocked up. If the windows are required for light or ventilation purposes, the opening must not be sealed completely unless other provisions have been made for ventilating the Refuge Room.

Since it is not likely that this country will be subjected to continuous and intensive high explosive bomb raids, the blocking up of window openings permanently with brick or concrete does not appear necessary.

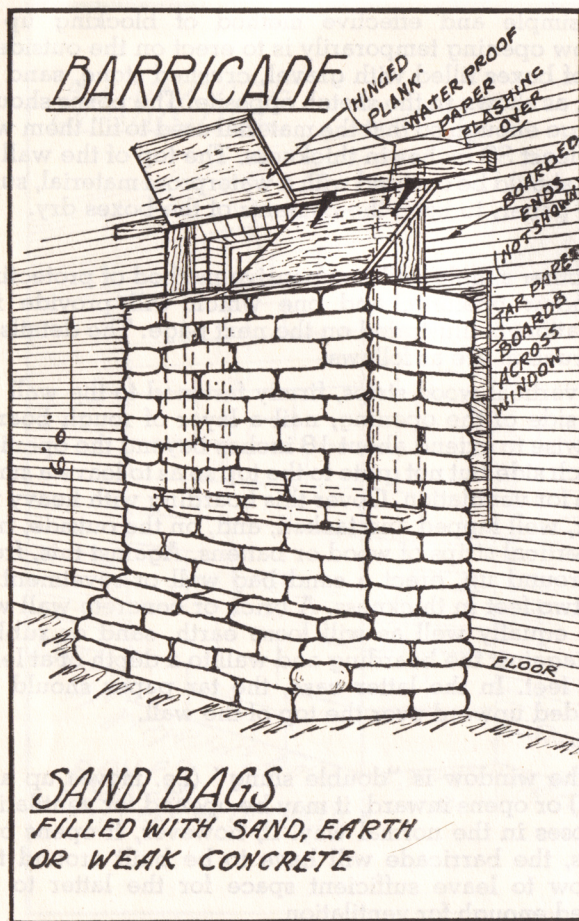


A simple and effective method of blocking up a window opening temporarily is to erect on the outside a wall of boxes filled with gravel, crushed stone, sand or earth, as shown in the sketch opposite. The boxes should be large enough so that the material used to fill them will be at least 30 inches in thickness. The top of the wall of boxes should be covered with a waterproof material, such as tar paper, to keep the contents of the boxes dry.

Another simple and inexpensive method of protecting a window opening, and one which will provide for ventilation, is illustrated on the next page. The details of construction are as follows:

To vertical wood strips, firmly fastened to the wall on each side of the opening, nail a layer of rough boards crosswise to extend about 18 inches beyond the opening on each side but not quite to the top so as to leave a small space for ventilation. Cover this boarding with heavy tar paper, well lapped and tacked, and, on the outside, nail two vertical strips of wood or battens. Against this, from the ground up, erect a sand bag wall or revetment at least two feet in thickness. A brick or concrete wall will serve equally well as will loose earth, sand or rubble piled against the boarding and wall to a depth of at least three feet. In the latter case, the tar paper should be extended upward over the top of the wall.

If the window is "double slung" (i.e. moves up and down) or opens inward, it may be opened for ventilation purposes in the normal way. If, however, it opens outwards, the barricade will have to be built around the window to leave sufficient space for the latter to be opened enough for ventilation.



The ventilation gap between the tops of the barricade and the window opening should be protected with heavy wooden shutters as shown in the sketch on page 18.

As protection against flying glass fragments, cheesecloth or some such fabric should be firmly pasted to the inside of the panes with paperhangers' glue or flour paste.

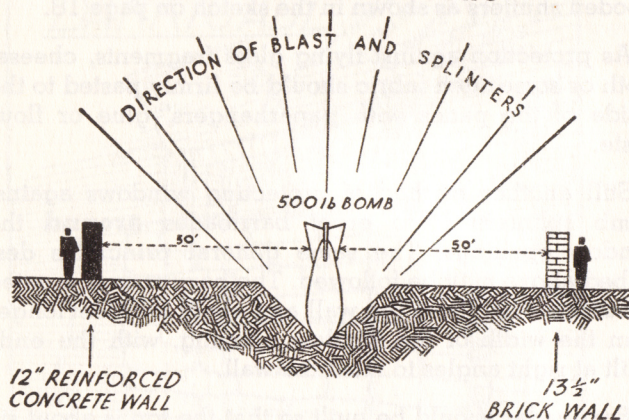
Still another method of protecting windows against bomb splinters is to erect barricades **around** the window openings. The same general principles described above may be followed. The barricade is erected about three feet from the wall and about four feet longer than the width of the window opening, with the ends built at right angles to meet the wall.

Barricades should be built so that the top is about six feet above the floor level of the Refuge Room in order to permit the occupants to stand comfortably.

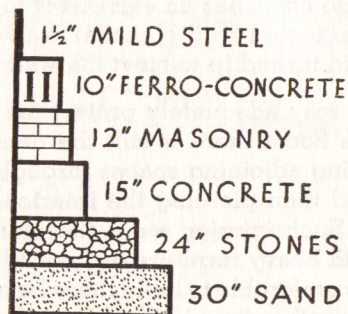
If your Refuge Room has an exit direct to the outdoors it should be protected with a similar wall or barricade having one end turned in to meet the wall of the house.

Though you may adequately protect the outside wall of your Refuge Room there is still the danger of bomb splinters entering adjoining spaces through windows or weak walls and then piercing the interior wall of your Refuge Room. Such interior walls, therefore, should be barricaded with heavy furniture or book-filled cases. To save space it is preferable to build these barricades in the adjoining room rather than in the Refuge Room itself.

PROTECTION AGAINST SPLINTERS



Thickness of Materials Safe against Splinters

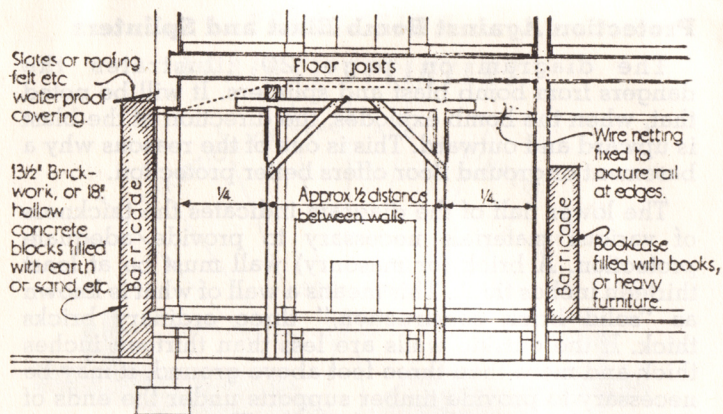


Protection Against Bomb Blast and Splinters

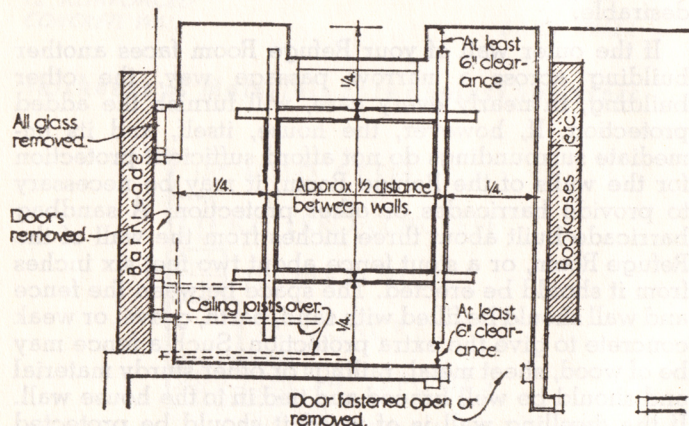
The diagram on page 20 illustrates the dangers from bomb blast and splinters. It will be noted that, when the bomb explodes, the direction of the blast is upward and outward. This is one of the reasons why a basement or ground floor offers better protection.

The lower half of the diagram indicates the thickness of various materials necessary to provide adequate protection. A brick (or masonry) wall must be at least thirteen inches thick. This means a wall of what is known as "solid brick construction," three ordinary bricks thick. If the outside walls are less than thirteen inches thick and more than three feet above ground, it may be necessary to provide timber supports under the ends of the joists bearing upon such walls. That is one reason why a room with the least amount of exposed wall is desirable.

If the outer wall of your Refuge Room faces another building across a narrow passage way, the other building, in nearly every case, will furnish the added protection. If, however, the house, itself, and its immediate surroundings do not afford sufficient protection for the walls of the Refuge Room, it may be necessary to provide barricades or other protection. A sandbag barricade built about three inches from the wall of the Refuge Room, or a stout fence about two feet six inches from it should be erected. The space between the fence and wall should be filled with sand, earth, gravel or weak concrete to give the extra protection. Such a fence may be of wood, sheet metal, railings or other sturdy material and should be well braced and tied in to the house wall. If the dwelling wall is of wood it should be protected with tar paper against moisture from the barricade.



SECTION THROUGH REFUGE ROOM



PLAN OF REFUGE ROOM

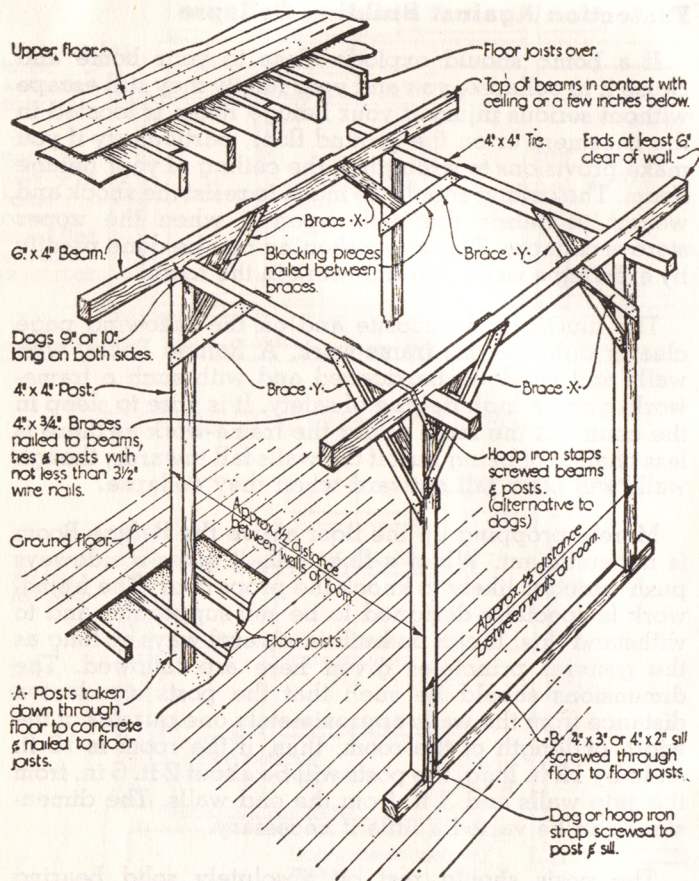
Protection Against Building Collapse

If a bomb should explode close to your home and cause it to collapse, you and your family may still escape without serious injury if your Refuge Room is located in the basement or on the ground floor, particularly if you make provisions to strengthen the ceiling of your Refuge Room. The ceiling should be made to resist the shock and weight of debris that falls upon it when the upper storeys collapse. This strengthening can be done readily by erecting a wooden frame-work in the room.

The illustrations opposite and on the following page clearly indicate this frame-work. A Refuge Room, with walls and windows barricaded and with such a frame-work, gives a high degree of safety. It is wise to sleep in the centre of the room under the frame-work as there is less chance of being hurt if the walls fall inwards, though walls will often fall outward when they collapse.

Merely propping up the floor above the Refuge Room is not sufficient. When a floor falls it gives a sideways push which is likely to knock the props over. The frame-work is specially designed to be self-supporting and to withstand this. It can be built in several ways so long as the general principles given here are followed. The dimensions should be such that the posts stand at a distance from the walls approximately one quarter of the width or length of the room; thus, if the room is 10 ft. wide by 12 ft. long, the posts will be about 2 ft. 6 in. from the side walls and 3 ft. from the end walls. The dimensions can be varied a little if necessary.

The posts should rest on absolutely solid bearing below, or be fixed to a heavy plank sill or beam which



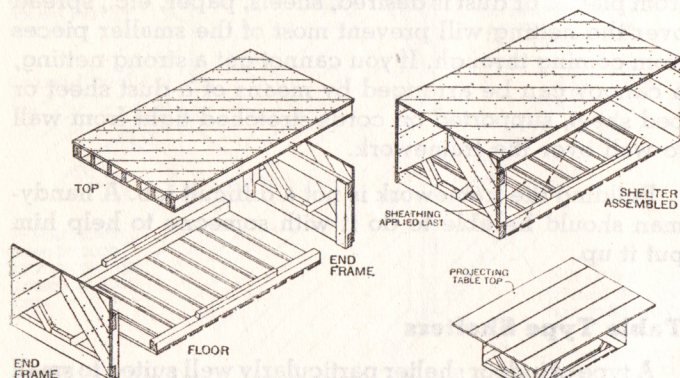
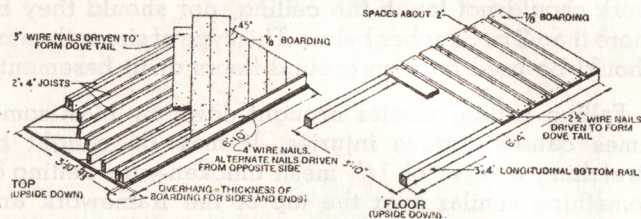
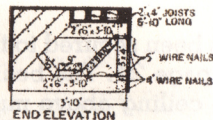
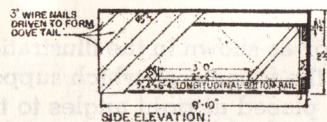
has been secured to the floor as shown in the illustration on page 24. The beams of the framework which support the ceiling above must be placed at right angles to the ceiling joists; the ends of the beams should not be nearer to the walls than 6 in. so that they will not be displaced by an inward collapse of the wall. The beams of the framework should not touch the ceiling, nor should they be more than 2 or 3 inches below. This type of strengthening should be used only on ground floors or in basements.

Falling ceiling plaster brought down by blast sometimes causes serious injuries. It may be caught by stretching a layer of $\frac{1}{2}$ " mesh chicken-wire netting or something similar over the top of the framework and fixing it to the walls all round the room. If more protection from plaster or dust is desired, sheets, paper, etc., spread over the netting will prevent most of the smaller pieces from coming through. If you cannot get a strong netting, a canopy can be arranged by means of a dust sheet or bed sheet, supported on cords stretched tight from wall to wall over the framework.

Building the framework is not a difficult job. A handyman should be able to do it with someone to help him put it up.

Table Type Shelters

A type of indoor shelter particularly well suited to small houses is one similar in design to the famous "Morrison Shelter" so widely used in Britain, but made entirely of wood instead of steel, which is now very hard to obtain for



Courtesy "ARCHITECTURAL FORUM"

TABLE TYPE TIMBER SHELTER

civilian uses. Detailed plans and specifications for the construction of this type of shelter appear on page 26. It is not difficult to build and its cost is relatively small.

While not proof against a direct hit, these table type shelters have been designed to withstand the much more likely risk of the building collapsing upon them. Under tests, the type illustrated has proved its ability to withstand a static load of 400 lbs. per square foot and the weight of a 1,000-lb. floor falling obliquely upon it from above—the way ceilings generally collapse. It also remained intact after a 350 lb. block of masonry had been dropped squarely upon it from a height of six feet.

The table type of shelter is so designed that the sides and ends will resist blows from loose bricks, pieces of masonry and other debris but provide four possible exits for its occupants. When not in use as a shelter, it can be used as a table.

The placing of this type of shelter is of the utmost importance. It should be in a room protected against blast, bomb splinters and gas, and it should be on a solid floor, that is, a basement floor, a ground floor with no basement underneath, or a floor that has been thoroughly strutted and braced underneath to withstand the collapse of the building.

It should be placed in the safest part of the room, with the fullest advantage being taken of existing protection against bomb splinters but **never** right in a corner. Preferably, it should be placed at least two feet clear of all walls in order to facilitate the exit or rescue of its occupants or, failing this, with one end against an inside wall. It should not be fixed to the floor.

What To Take Out Of Your Refuge Room

Remove from your Refuge Room all unnecessary articles, especially light and breakable articles which might be thrown about by the shock of bomb blast and cause injury. This includes pictures, vases, clocks, bric-a-brac, glass lighting-fixture shades, small lamps and the like. With the whole family in one room, space will be precious.

Essential equipment and accessories should be made secure. This applies especially to stoves, stovepipes and appurtenances.

What To Take Into Your Refuge Room

If possible, your telephone should be in or near the Refuge Room but it should never be used during an alarm except in an emergency. Your radio should be there to provide entertainment and a possible means of receiving important warnings. During a raid all radio stations will go off the air but before that happens, information of importance to your safety may be broadcast.

An ample supply of drinking water and prepared food should be taken to the shelter along with the necessary dishes, silverware, etc.

There should be warm clothing for all the family and sufficient blankets and pillows to make rest as comfortable as possible. Do not use fuel stoves for heating the Refuge Room. They consume oxygen.

Medical supplies ordinarily used by the family and articles for sanitation purposes should not be overlooked and, of course, the family First-Aid Kit must be on hand.

Books, games, knitting and other pastimes are important for they help keep up morale during a tedious vigil.

A shovel, pick-axe, hammer and nails, flashlights, candles and safety matches, sand to deal with fires and water for incendiaries should be provided.

Try to anticipate how you will spend your time in the Refuge Room and plan to have at hand anything which will make for comfort of mind and body.

Your Refuge Room Door

We are all accustomed to regard locked doors as a protection. Since your Refuge Room is designed for the protection of your family, it would be the most natural thing in the world to close the door tightly, even to lock it. **Don't do it.**

Should your home be destroyed by bombs, your Refuge Room will save your life but quick escape will be important, especially if fire follows. A closed door almost certainly will jam in any collapse. To chop it down takes time and may result in tons of debris falling upon you. **Keep your Refuge Room door open during an Air Attack.** Tie it loosely so that it can swing slightly and not be torn off its hinges in case of blast, but provide a strong door stop so that it cannot slam shut.

To prevent light from showing through the Refuge Room door a curtain should be placed over the opening.

Gas, Electricity and Water

When the air warning sounds turn off gas immediately at the main. Know where the main electricity switch and the shut-off valves for water are, so that you can turn them off quickly if necessary.

A Final Word of Caution

If a raid occurs during the winter or when stoves and furnaces are in use, set the dampers so that the gases will escape in the usual way. Do not attempt to put the fires out. Make sure that stove pipes and flues are well wired or otherwise supported so that they will not be displaced by the effects of bombing.

Experience in war areas has shown that civilian casualties fall to very small numbers when people learn to take cover and avoid exposing themselves in the open to bomb and anti-aircraft splinters, machine-gun bullets and flying glass.

The important thing to remember is that you are safer at home than running into the streets and seeking other shelter when an Air Raid warning sounds. And you will certainly be much more comfortable in your own Refuge Room.

No shelter is proof against a direct hit from a heavy bomb, but the chances of your own house suffering a direct hit are very small. Therefore, stay at home or, if you are not far away when a warning sounds, get back quickly to your own home and refuge. On no account look out of the window during an air raid.

If you are not near home and are caught in the street or in the open make use of the best cover you can find. Remember that bomb splinters usually fly slightly upwards. Therefore, if you are in the open with no cover, lie down flat and protect the back of your head. If there is a ditch, get into it, or if there is a low mound or wall, get down behind it.

If you are caught in a street, go into the nearest building used as a shelter. You should know the locations of such shelters in the places and streets which you frequent.

Do not, however, waste time hunting for a shelter. Go into the most solid-looking building near you. Inside corridors and passages are safer than rooms with windows. If in a room, sit on the floor against a wall between windows and avoid all places where bomb splinters or flying glass can hit you.

If you cannot get into a building, get under an archway.

Always take cover. Never go into the open to watch anti-aircraft fire or aerial battles. They may be very fascinating, but they are dangerous.

Another point is this: if you live in a well-built house or have a good refuge, look into the street when the warning sounds and see if there is a passer-by wanting shelter. Ask him in. You may be a "passer-by" in the next raid.

The Air Raid Warden is your friend, anxious to help you in any way. Seek his advice and you will find it helpful.

This is a valuable booklet and the supply is limited. Preserve it carefully, study it, and have all members of your household do likewise.

This booklet is one of a series prepared and distributed for the guidance of the public by the Office of the Director of Civil Air Raid Precautions, Daly Building, Ottawa, Canada.