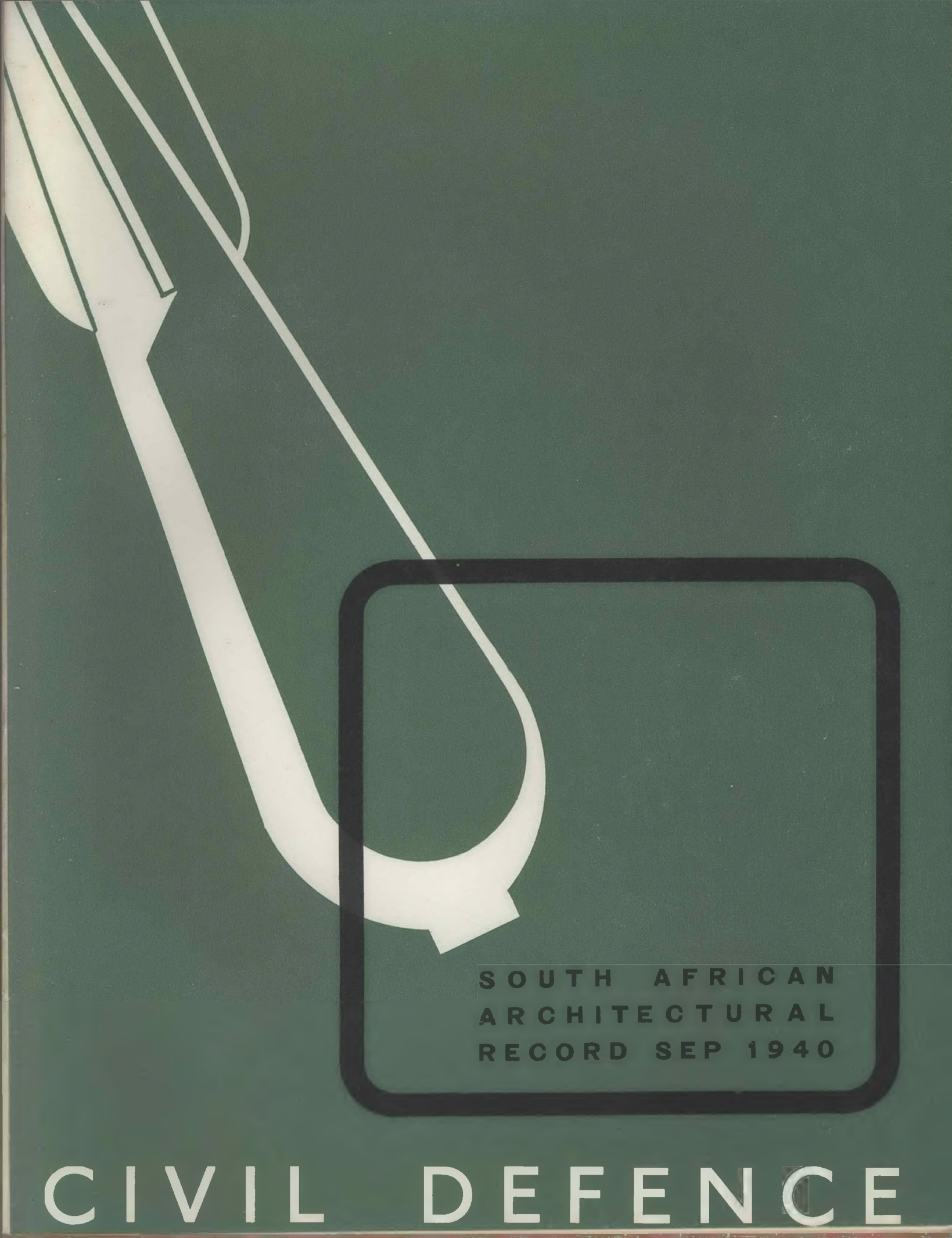




SOUTH AFRICAN
ARCHITECTURAL
RECORD SEP 1940

CIVIL DEFENCE

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MEASURES FOR SOUTH AFRICA

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CIVIL DEFENCE

CIVIL DEFENCE IN SOUTH AFRICA

An Introduction to two Reports on Civil Defence Measures for South Africa, and a review of subsequent events in South Africa and Great Britain as they affect the findings contained in these reports.

This issue of the South African Architectural Record is devoted to the subject of Civil Defence in South Africa. Civil Defence is a problem to which the architectural profession as a whole can bring an admirable equipment in technical knowledge and administrative experience. The architect's training in large scale planning, in the co-ordination of the many and varied technical activities connected with building, and in the adjustment of related and sometimes conflicting programme requirements, gives him a special place in the formulation and carrying out of comprehensive measures for Air Raid Protection. Many other professional bodies, of course, must play important roles in the computation of essential data in the first place, and ultimately in the practical design and construction of structural defence measures, but the architectural profession is peculiarly adapted to evolve and to direct a widespread yet correlated plan.

It was with this conviction that a group of architects approached the Central Council of the Institute of South African Architects with the request that the institute interest itself in this vital question. The Central Council accordingly appointed an Architects' Committee on Civil Defence, with wide powers of action. After a short period of collaboration the A.C.C.D. presented a report dated June 7th, 1940, on "National Civilian Protection Measures for South Africa" to the Hon. the Minister of the Interior at Pretoria. Official reception of this document was such as to encourage the A.C.C.D. to prepare a more comprehensive report, including a chart and diagrams, and this in turn was presented to and accepted by the Union Government, through the Officer Co-Ordinating Civilian Protective Services, Major T. B. Clapham, M.C., on June 24th, 1940. This report was accompanied by a schedule detailing the very fine response of Architects and Quantity Surveyors throughout South Africa to a circular addressed to these two professions by the A.C.C.D., in which their assistance in the matter of Civil Defence was requested. These documents were favourably received by Major Clapham,

The two reports together with the Chart and Diagrams, are reproduced in the following pages, and give, we think, some indication of the architectural approach to a problem such as Civil Defence. It is not claimed that the Reports deal exhaustively with every aspect of Civilian Protection. Obviously, the time and circumstances in which they were prepared were too limited to allow of definitive findings on all points. They do, however, summarise in a relatively compact form the probabilities of forms of air attack, the categories of objectives, the organisation of personnel, and the possible means of protection. The reports followed intensive research amongst many factual papers the relevant data of which had been collated over a long period from overseas technical publications. Not content with work of only a correlating nature, the A.C.C.D. has designed shelters suitable in its opinion for South African conditions. Here again only the most generalised solutions were possible in the time. Nevertheless, as an architectural contribution they will repay close scrutiny, and in principle are true for the findings on all relevant factors established in the reports. Since that time intensified aerial attacks on Great Britain have developed. Measures taken in Great Britain have been subjected to the ultimate test, and such press reports as have been published form an interesting commentary on the effectiveness or otherwise of these measures. The recommendations of the A.C.C.D. reports can be evaluated afresh in the light of this experience.

The time has come indeed to analyse the precautionary measures taken in Great Britain previous to the latest attacks, the results obtained from these measures under test, the proposed measures so far known to the general public for South Africa, and the findings of the A.C.C.D. on the whole subject of protection. It will be apparent to those interested in C.P.S. for South Africa that there is a wide divergence between the views expressed in our reports and the proposals so far put forward by the local authorities throughout the Union. Fundamentally, the difference lies in the fact that our reports recommend NATIONAL CONTROL over all protective measures, while up to the present the methods of protection in South Africa are left to the discretion and initiative of Local Authorities. The following reports clearly indicate, however, that the carrying out and administration of methods evolved under Government direction would necessarily be in the hands of the Local Authorities, and to that extent there is agreement. A significant and timely comparison can be drawn between the position in England previous to the declaration of war and that in South Africa to-day. The analogy in terms of threatened danger is probably an apt one. Although

the measures taken in England at that time were open to strong criticism, yet, even at that, the Government formulated an A.R.P. code, which dealt with the many aspects of passive defence. There was a distinct tendency, however, to minimise the danger of immediate attack, so that the measures laid down were not always of a comprehensive or effective nature. The emphasis on gas and incendiary bomb attack tended to exclude a proper consideration of defence against high explosive bombing. Much work dealing with organisation was undertaken in the direction for example of the establishment of first aid posts, and the formation of decontamination and demolition squads, all essential to A.R.P., but a complete system of protection was not satisfactorily laid down. It is true that types of shelter were suggested, but the degree of protection which they afforded was a minimum, and certainly not calculated to withstand intense modern aerial bombardment. There was no attempt to take advantage of the experience gained in the Spanish Civil War, or in China, in spite of the fact that many authorities, among them Professor Haldane and the firm of architects Tecton, underwent the ordeal of air raids in Spain for research purposes. These authorities, in subsequent books on A.R.P., implied severe criticism, not only of the recommendations laid down in the code but pressed for a greater degree of responsible action, to be undertaken by the Government. Tecton stated in their book "Planned A.R.P.": "A.R.P. had, of course, been organised on a national scale for some time before the crisis of September, 1938, which brought its importance home so forcefully to the public consciousness. But it needed that almost universal belief in the imminence of war, with its terrible threat to our cities, to arouse a general interest in the problems involved. The crisis experienced showed how far we in this country [England] still were from any rational solution of the questions of A.R.P. The haphazard spending and the lack of organisation, culminating in tremendous waste of effort and considerable profiteering, not only seriously drained the financial resources of local authorities, but, far more grave, the confidence of the public was to a great extent undermined by the spectacle of such obvious inefficiency. Indeed, the civilian morale (the preservation of which is, of course, one of the main objectives of A.R.P.) was so greatly endangered, that nothing short of a complete technical clarification of the whole situation will now have any value in restoring it."

No doubt a great deal of expansion in A.R.P. took place after the outbreak of war, but it does not seem that full protection is afforded as yet to any large percentage of the civil population. This is borne out in a report which appeared in the "Sunday Times," (Johannesburg), of September 22nd, 1940:

“ The invasion of Great Britain, the Egyptian operations, and even the operational side of night bombing, take second place at the moment to the problem of providing shelters for Londoners. With the intensification of German night raids, it has become the most pressing of all public issues.”

Here, in South Africa, the Government has instituted a Department of Civilian Protective Services the function of which appears for the most part to be directed towards co-ordinating the activities of local authorities in all parts of the country. It must not be assumed from this that local authorities are in a position to formulate and to undertake comprehensive protective measures.

There are, in fact, many aspects of protection which must of necessity be in the hands of Government Departments. We need mention only matters such as systems of air-raid warnings, or steps for precautionary evacuation, to make clear the necessity for central control and authority at least in these directions. Successful co-ordination, however, is possible only if the end to which all measures are directed is clearly defined and made known. In this respect the peace-time code laid down by the British Government was a virtual necessity, whatever its limitations. In a country at war the necessity for such a code is not less pressing. Of course, what determines the attitude of the general public (and, it might be added, of the Government and the Local Authority) to C.P.S. is the degree of danger to which we are subject at the moment. The geographical situation of South Africa appears to render the possibility of air attack remote, but Government and other official spokesmen have made it clear on numerous occasions that the possibility does exist. Once admit this possibility, and the need for protecting the Civilian population to the maximum of available resources is apparent. No Government in a country at war can turn aside from the protection of the whole of its people. The people, too, on whose behalf, after all, the measures are to be taken, should know the whole truth regarding all proposals—the varying degrees of protection which suggested shelters provide, the methods of appointing wardens and other officials in the various organisations, the financing of the various services and the methods of setting them into operation, and the official attitude towards the different sections of the population on all these points. In fact, all information on this vital subject should be available to the public, as far as military considerations permit.

Now, in South Africa, up to the present, it seems that a great deal of attention has been given to the organisation of the many services which operate during air raids. Apart from the warden sections, however, what appear to concern the authorities most are the devastating results of aerial bombardment. We will have casualty posts (should they remain intact), rescue parties, decontamination squads (against the use of gas) repair gangs, ambulance and hospital services, all ready to deal with the very large numbers of casualties we may expect from the unloading of high explosive, incendiary and gas bombs from enemy aircraft. Protective measures seem to be at a discount. We do not wish to convey that they are not mentioned—they do in fact receive headlines such as "City Plans for Bomb-proof Shelters," or much detail as to the cost of shelters available to all who are prepared to "send the cheque to the Master Builders' Association." ("Rand Daily Mail," September 24th, 1940). What is lacking is a frank analysis of the effectiveness of such shelters, and open discussion of the principles involved in providing protection. In the first instance, the term "Bomb-proof Shelter" is loosely used—it cannot possibly be meant to cover the types often enumerated at various costs in newspaper reports. "Bomb-proof" means proof against bombing, presumably bombing of any known variety of weight and combination. There are few shelters, indeed, which may be called bomb-proof. According to all available figures depth shelters at sixty feet below ground surface, or shelters covered by five feet of reinforced concrete with a deep layer of earth above and further protected by a concrete detonating slab, and fulfilling numerous other structural conditions, may be considered bomb-proof. What all other shelters can give is something less than this desirable maximum protection, and this fact should be generally known. C.P.S. officials in Johannesburg are reported to have stated that a shelter could be constructed for less than £1 5s. 0d. ("Rand Daily Mail," September 25th). By shelter, obviously bomb-proof cannot be implied. In fact it would be most instructive for a demonstration of the building of such a shelter to be arranged, more especially if the Military Authorities would consent to stage a bombing display after its completion. We do not go so far as to suggest that the officials reported to have made the statement should demonstrate personally the effectiveness of their shelter. The point to be noted is that there are degrees of protection, which vary from approximately 10% reduction in risk to the individual in the most crude form of trench to 70—80% reduction in a properly designed surface shelter, and ultimately 100%

reduction to complete safety in a bomb-proof shelter. Loose terminology may easily spring from loose thinking or even ignorance of the subject, so that more precise information based on skilled technical research must be made available to the public. Such information must necessarily reduce the public's inevitably unfavourable reaction should measures purporting to be comprehensive and effective be put to the test and found wanting. Public morale is a fundamental requirement in combating aerial attack. Of course, all measures may sound reasonable if it is assumed that they will not be put to the test. This is an assumption which we, for ourselves, are not prepared to make.

A further aspect of local A.R.P. schemes worthy of discussion is the "provision" of shelters. The protection of the civilian population is a matter that vitally affects every individual within the community. The protection of single elements or groups cannot be achieved unless there is collective protection. The essence of the problem can be summarised as equal protection for all, according to the degree of danger to which each is subjected. This is a principle that is fully dealt with in the reports that follow, but, judging from local developments, the strongest emphasis must be placed once more on this fundamental issue. Here, in this country, it would appear, protection may be afforded according to means—an arrangement that can hardly be defended. It is true that there has been some suggestion of monetary assistance to those unable to pay for their own shelters, but it must surely be obvious that this is only scratching the surface of the problem. The very considerable poor quarters of our towns—the large Bantu, Asiatic and Coloured communities within their boundaries—must render abortive any such clumsy attempt to find a general solution. The domestic shelter, it has been said "would form the foundation of the whole system" (of shelters). ("Rand Daily Mail," September 24th, 1940.) But our population is hardly as static as that. The daily movement within cities is such that, on the average, twelve of the twenty-four hours of the day are spent by most people away from their homes. This daily transference of population with peak periods of movement complicates the whole issue. No scheme of protection can be considered complete unless the static, moving and transferred sections of the population are equally provided for. To this one must add the difficulty of protecting in an equal measure the Bantu, Asiatic and Coloured people, a complex problem in itself and one which basically affects the planning of all types of shelters.

We have also, in our consideration of local schemes, to deal with the question of dispersal. It is commonly thought that small shelters dispersed over a wide area give greater protection against indiscriminate

and sustained bombing than large communal shelters at a few selected points within the same area. A simple mathematical calculation will show that the risk of being hit to an individual in the given area is identical in both cases. When protection is taken into account, it is obvious that the risk is the same only when the protection provided is equal. Technically, however, and economically much more can be done for the same cost in the case of the communal shelter, or alternatively, equal protection can be provided at a much lower cost. There are further advantages in the communal shelter, psychological and social factors which need no elaboration here.

We may instance in this connection the situation in England before and during the recent heavy aerial attacks. It has been stated here ("Rand Daily Mail, September 24th, 1940) that "the shelter policy of the Johannesburg C.P.S. would be similar to that in England. The only exception at present was that it had not yet been decided whether free shelters would be provided for the poorer sections of the community." In England Anderson shelters were distributed to people in the crowded areas of the towns ("the poorer sections," naturally). The shelters were erected in the yards of the houses in these areas. Now in theory the idea of providing a shelter to each house is an admirable one, but is acceptable only if a reasonable degree of protection is afforded. The Anderson shelter undoubtedly reduced the risk of injury from some of the effects of bombing. We would not estimate this reduction at more than 10% in the absence of more precise information.

It certainly could not withstand the more devastating effects of blast or shock, though the danger from splinters or falling debris is somewhat lessened. This reduction in risk hardly compensates for the almost insuperable difficulties of providing practicable drainage and sanitation and for the discomfort inevitably experienced in nights spent under such crude and unhealthy conditions. The fact of the matter is that these shelters did not intelligently anticipate the grim reality of air raids, and are therefore not suitable for use in crowded city areas. We base these conclusions on the report published in the "Sunday Times" (Johannesburg), of September 22nd, 1940, which was headed "Deep Dormitory Shelters are London's Chief Present Need," and further reported as follows "It was originally thought that all that was wanted was the provision of large numbers of shallow refuges where the inhabitants could find protection for brief periods during an air raid. It is now realised that London must provide shelters which will be virtually dormitories, where, instead of spending an hour or two, many people will pass nearly the whole night and

part of the day. With the coming of winter, the shelters must be warm and at the same time well ventilated. They must have adequate sleeping accommodation and sanitary safeguards. The problem is already a grave one for the well-to-do, thousands of whom have left, perhaps only temporarily, their menaced flats and houses, but for the poor it is one of some complexity for bombs dropped in the crowded East End wreck many more houses than in the comparatively spacious quarters of the West End and the better class suburbs . . . The poor are trekking westwards in numbers nightly, and filling the tube stations with a consequent threat to traffic. They prefer the tubes, and large shelters to small ones, but at the same time, so strong is their attachment to their homes, that they like to trek back to them every morning and take their families with them."

We must point out that this state of affairs was foreseen with appalling accuracy by Tecton, the architects, who in the light of personal experience and with the advantage of a scientific approach to the problem, were able to assess exactly the relative merits of current proposals (and incidentally to put forward a brilliantly practicable and economical solution at the same time). With this experience behind us it would be foolhardy in the extreme, not to say criminally negligent to repeat preventable errors, and it is essentially the architect's function to analyse and correlate proposals made from all quarters, as well as to evolve practical and efficient solutions.

The reports of the A.C.C.D. were compiled before London experienced the recent heavy air raids. In general the suggestions put forward for the organisational and structural methods of Civil Defence hold good to-day. The proposals embodied in the reports that an A.R.P. policy should emanate from and be controlled by the Government, and that the Local Authorities be responsible for putting into operation the decisions arising from that policy, are thoroughly vindicated when we read that, in England, **"The Government departments and local authorities are handicapped in dealing with the problem by the fact that their powers overlap."**

("Sunday Times" (Johannesburg), September, 22nd, 1940.

The structural methods of defence that have been planned illustrate a firm conviction that communal shelters frequently give the best solution for certain conditions. The small, individual shelter is not shown in the reports, but we are certainly not opposed to such a solution where circumstances permit. In this instance,

however, the A.C.C.D. was more concerned with the problem presented by the necessity to protect the major portion of the population to a reasonable degree of safety. The shelters illustrated are, with one exception not bomb-proof, but, in relation to the danger inherent in their situation, they give a satisfactory reduction in risk to the individual. While the scheme put forward provides an acceptable degree of safety, it has been designed in a way that will ensure that at all stages in the process of construction a progressive proportion of protection is made available to the public. It is possible, therefore, for the authorities to time their building programme advantageously in relation to the imminence of danger.

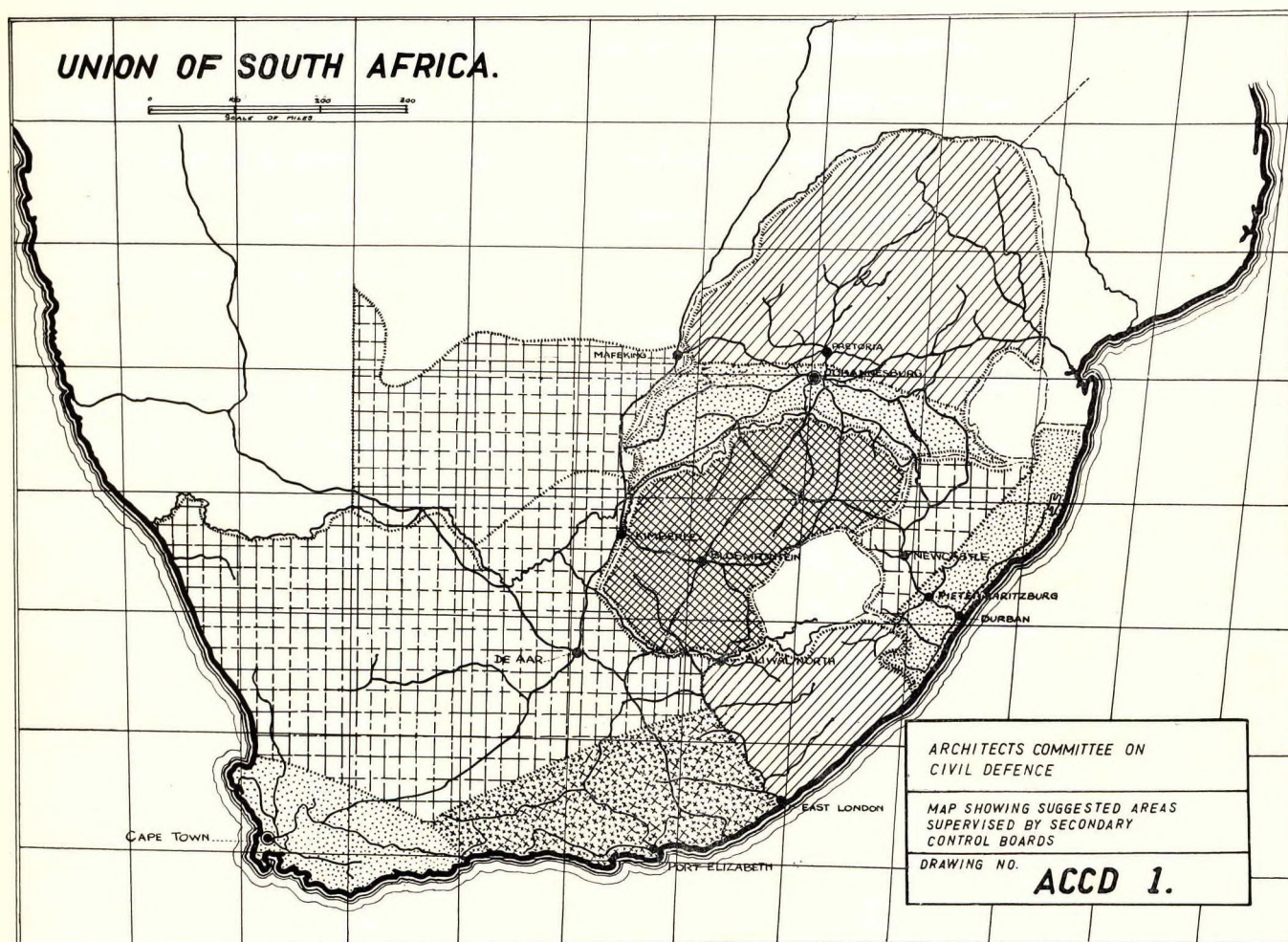
The attitude of the A.C.C.D. towards the use of basements as shelters was that they must fundamentally conform to the standards laid down for surface shelters. That would obviously entail extensive structural alterations to existing basements, but it still remains to be shown that the majority of them could ever be rendered completely satisfactory or that the building of shelters on available open spaces is not in general a more feasible and economical proposition, particularly if future conversion to peace-time use is borne in mind. It is clear, we think, that the principle to which the A.C.C.D. has adhered of building communal shelters can be further justified when the day and night distribution as well as the movement of the population are taken into account. The suburban and central surface shelters would be adequate to cope with these varying conditions, and all sections of the population would be within reasonable range of a public shelter of one type or the other.

Finally the following reports may be considered as a preliminary investigation into an urgent problem of national importance. The solution for each South African town remains to be arrived at in relation to local conditions, but the general principles which have been established should determine the nature and direction of the individual solution. It must be remembered, too, that the reports were written with special reference to the work that the Architectural and Quantity Surveying professions are best able to undertake in a comprehensive scheme of Civil Defence. If the potential value of this work has been firmly established, the research that has gone into the preparation of these documents has been amply justified.

N.H., R.M., W.G.M.

It is suggested in the second report that the Union of South Africa be divided into areas reflecting the density of population and the relative strategical importance and degree of industrialisation. This has been done to facilitate organisation and control.

This map should be read in conjunction with the chart which appears later in this issue.



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REPORT ON NATIONAL CIVILIAN PROTECTION MEASURES FOR SOUTH AFRICA

[An Introductory Paper presented to the Hon. the Minister of the Interior followed by a Second Report on pages 329—354 of this issue in which the subject is more fully treated.]

June, 7th, 1940.

Study of recent events in Europe emphasises that the problem of civilian defence is one that must be tackled without delay and with all the resources available in South Africa. Every country is becoming increasingly aware of the necessity of taking comprehensive measures on a national scale, to ensure protection and safety within its borders. One need hardly stress the fact that such measures are imperative in a country at war. South Africa, at this moment, is within range of the theatre of war, and if Canada (remote though she is) has seen fit to undertake an elaborate system of civilian defence, how much greater is the need for this country to take immediate steps?

"A.R.P." is a term the significance of which has taken on aspects little thought of at the outbreak of the present war. The problem goes beyond the provision of protective measures only. Direct military aggression by means of parachutists has become a likely method of attack. In addition sabotage elements within every country may be brought into direct contact with enemy troops, and in consequence constitute the greatest danger to national integrity. It has been shown by experience in Europe that organisations originally set up for A.R.P. are those best suited for conversion into defensive units in the full military sense. In South Africa, therefore, where until now no comprehensive national scheme for civilian defence has been set in operation, the opportunity to undertake the organisation of A.R.P. in conjunction with military defence should not be missed, as it offers an immediately practicable course. National civilian defence involves the enrolment of every loyal citizen not engaged in active military service for specific duty within a national framework. This necessitates the formulation of a comprehensive scheme in which every individual would be trained and equipped to play an active part in the nation's war effort. The result of such a course would be twofold: first, it would induce in a universal measure a consciousness of personal responsibility, and second, it would provide a unifying factor in the face of common danger.

The fact that adequately planned provision would be made to protect the civilian population would serve to create confidence within the fighting forces. The strengthening of morale resulting from such disciplined action would be of incalculable value at moments of crisis and emergency.

THE PROBLEM OF NATIONAL CIVILIAN DEFENCE ENTAILS THE PROTECTION, PARTIAL OR COMPLETE, OF LIFE AND THE SERVICES NECESSARY FOR THE MAINTENANCE THEREOF IN THE FACE OF ENEMY ATTACK.

ATTACK IS POSSIBLE IN THE FOLLOWING FORMS :

1. Aerial bombing by means of :
 - a Gas bombs;
 - b Incendiary bombs;
 - c High explosive bombs of various types, weights and degrees of effectiveness.
2. Bombardment from warships.
3. Landing of armed parachutists.
4. Sabotage elements within South Africa, operating with (3).

OBJECTIVES FOR ENEMY ATTACK FALL INTO THREE CATEGORIES :

1. Urban and Rural population:

(Towns to be graded from densely to sparsely populated areas and a distinction is to be made between inland and coastal towns.)
2. Essential Services comprising:
 - a Rail and Road communications, including junctions, stations, goods yards and termini.
 - b Post and Telegraph services and Radio Stations.
 - c Harbours and shipping.
 - d Industrial Units.
 - e Witwatersrand Gold Mines and adjuncts.
 - f Power and Water supplies.
 - g Grain Elevators and Petrol Storage Tanks, and Warehouses.
3. Public Institutions, including Hospitals, Schools, Post Offices, Town Halls, Art Galleries, Libraries and Prisons.

4. Military Establishments comprising:

- a Aerodromes.
- b Army camps.
- c Permanent barracks.
- d Staff Headquarters.

AVAILABLE PERSONNEL FOR PARTICIPATION IN CIVIL DEFENCE :

1. Official Bodies:

- a Government Departments controlling Railways, Public Works, Police, Public Health, Posts and Telegraphs, the Broadcasting Corporation, Universities, etc.
- b Provincial administrations controlling Schools, Hospitals, Roads, etc.
- c Municipalities comprising Town Clerk's Department, Town Engineer's Department, M.O.H.'s Department, Fire Department, and Traffic Department.

2. Civil Organisations:

- a Architectural Profession.
- b Medical Profession.
- c Mining Technicians.
- d Scientific and Technical Bodies.
- e Building Trade.
- f Trade Unions.
- g Motor Trade.
- h Native Organisations.
- i Youth Organisations.

3. Military Controlled Organisations.

- a Ex-Service Men.
- b Police Reserves.
- c Womens' Auxiliary Corps.

4. Religious Organisations:

5. Commercial Organisations, including Food Distribution and Clothing Manufacture.

MEASURES TO BE TAKEN SHOULD INCLUDE THE FOLLOWING :

As enumerated on page 324, enemy attack is possible from the air in three forms, namely, gas bombs, incendiary bombs and high explosive bombs. In the following measures the assumption is made that, whatever form the protection takes, GAS MASKS will be provided for every section of the community.

1. Military Protection:

It is assumed that protective measures in the form of fighter aeroplanes, anti-aircraft guns, and units to deal with parachutists will be organised by the military authorities. Warning of the civilian population against air attack may well be combined with these measures.

2. Preservation of Essential Services:

The necessary steps for maintaining service and production of essential commodities should be undertaken by such methods as decentralisation, the creation of skeleton means of production with alternative plants, and adequate guarding at all key points.

3. Evacuation :

This measure falls into two divisions :

- a The departure of evacuees.
- b The reception of evacuees.

The departure of evacuees involves :

- A Children.
- B Aged and Infirm.
- C Hospital Patients.

The removal of the non-active section of the civilian population to positions of safety should be undertaken when the war situation points to the possibility (however remote) of air attack.

- A For the removal of children between 5 and 17 years of age the existing school organisations with teaching staffs would be utilised. The personnel could be extended to include youth and religious organisations.

Mothers and babies would come under the control of Womens' Organisations and such bodies as the Red Cross Society.

- B The aged and infirm could be handled by bodies such as the Rand Aid Association, whose

work involves the care of this class.

- C In times of emergency it would be desirable to free the hospitals of all patients who could possibly be transferred to the country. This removal might be undertaken under the supervision of hospital and university medical staffs with the assistance of voluntary medical associations and medical students.

The transport of all these evacuees would involve the co-operation of the S.A. Railways, the Municipal Bus Services, and privately-owned motor cars in a prepared, rehearsed and co-ordinated service.

The reception of evacuees necessitates the planned sub-division of reception areas at suitable distances from the urban areas.

The mechanism of reception entails not only the utilisation of existing accommodation (altered or unaltered) but also the probable building of new evacuation camps.

Such measures as the provision of food and clothing, medical care, teaching and home contact would form the basis of the reception programme.

The administration of these services would be in the hands of the District Magistrates utilising the services of the District Surgeons and the personnel of the Town or Village Councils.

4. Construction of Shelters :

The first requirement under this heading is a detailed survey of the area under consideration, to establish such vital factors as the density distribution for day and night of the population and its degree of movement, incidence of open spaces, the distribution of business and domestic elements, the heights and structure of buildings, the contours, the geological formation at various depths, the various systems of water, electric power and gas supply, and sewage disposal.

Buildings categorised for special treatment :

a Public buildings including :

Government Offices, Municipal Offices, Railway Headquarters, Hospitals, Prisons, Mining Houses, Schools, Technical Colleges, Universities, Headquarters for Electric and Water Supplies.

b Domestic Buildings.

- c Flat and Office types of Building.
- d Factories and Industrial Units.
- e Mining Industries
- f Native Townships.

The solutions to the problem may be enumerated as follows:

- A Inspection of individual structures to determine their strength, fire resisting properties, etc., with a view to making suitable alterations to give some degree of protection.
- B Use and conversion of suitable rooms in existing houses and buildings where the danger factor is relatively low.
- C Protection of streets and ground floor facades of buildings, with special reference to projecting verandahs, plate glass windows, etc.
- D Investigation of the use of mines for shelters.
- E Construction of trenches of types suited to specific purposes. This measure may be important in the case of a short term programme, especially in view of the limited machinery required for execution.
- F Construction of tunnels at a suitable depth below ground level, with special reference to the possibility of utilising kopje formations.
- G Construction of bomb-proof shelters at predetermined points in the area under consideration. These present a highly specialised problem requiring the close collaboration of architects, engineers and scientific researchers.

Perusal of the above will indicate that the requirements of any valid scheme which is to offer uniform protection to the whole population of South Africa can only be initiated and can only function successfully in practice if its complete organisation and control are vested in the highest authority. It is submitted that this proposal to organise a scheme of national civil defence must follow the lines indicated in this report, and cannot be entrusted to the efforts of isolated, voluntary bodies without fully legalised and central control.

Drawn up by order of the Central Council of the Institute of South African Architects, and submitted by the ARCHITECTS' COMMITTEE ON CIVIL DEFENCE.

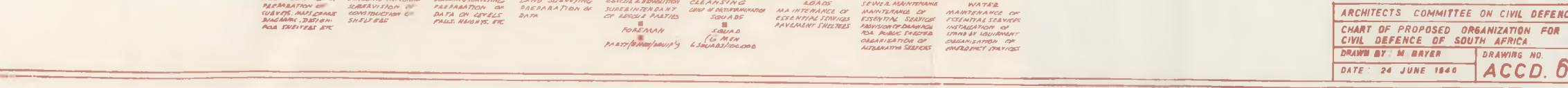
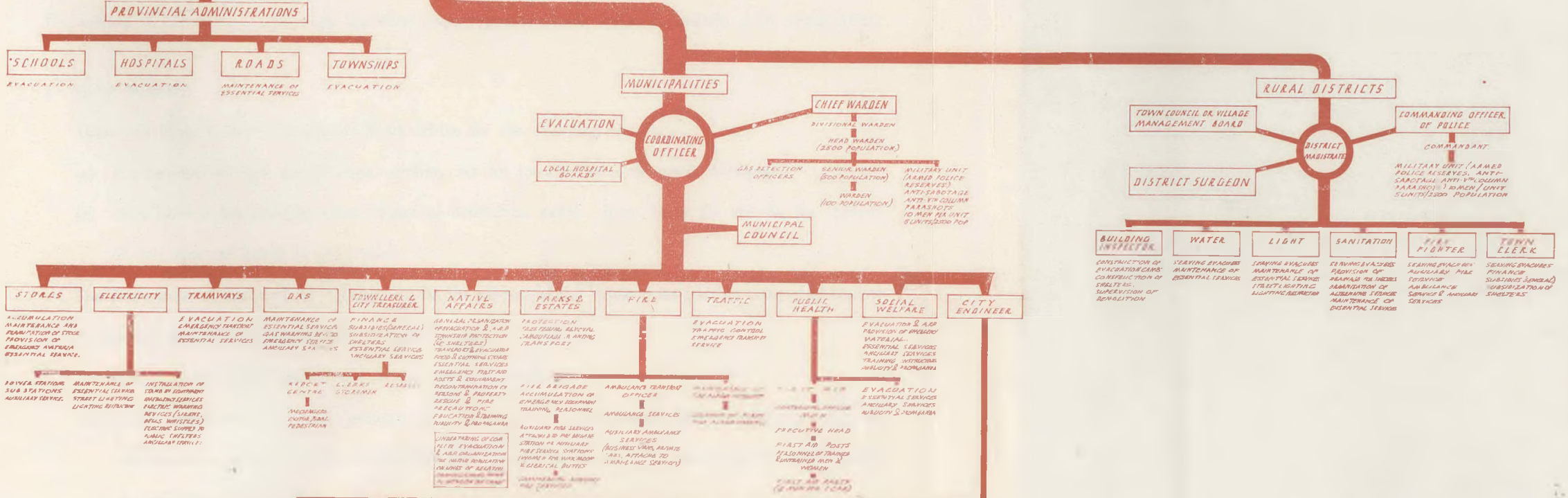
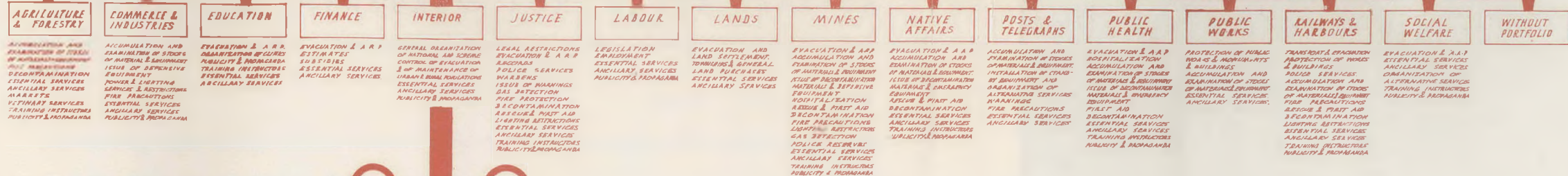
(Signed) D. S. HADDON, Chairman.

(President-in-Chief of the Institute of S.A. Architects).

NORMAN HANSON.

REX MARTIENSSEN,

DEFENCE



ARCHITECTS COMMITTEE ON CIVIL DEFENCE
CHART OF PROPOSED ORGANIZATION FOR CIVIL DEFENCE OF SOUTH AFRICA
DRAWN BY: M. BRYER
DATE: 24 JUNE 1940
DRAWING NO. ACCD. 6.

SECOND REPORT ON NATIONAL CIVILIAN PROTECTION MEASURES FOR SOUTH AFRICA

June, 24th, 1940.

The following report on Civil Defence measures for South Africa is an extension of the initial report dated June 7th, 1940, and submitted by the Architects' Committee on Civil Defence to the Hon. the Minister of the Interior, and the two documents are intended to be read in conjunction with one another. The present report is a survey of the whole problem of civil defence in this country and includes an analysis of methods of enemy attack, the categorising of objectives, an investigation of recognised methods of protective construction, and a chart detailing the complete administration necessary for a Government controlled national scheme. Recommendations, together with the necessary diagrams for a practical course of action, are made under each section of the report, so that a composite and connected impression of an all-embracing scheme of Civil Defence may be envisaged.

PROBABLE METHODS OF ENEMY ATTACK:

The enemy, in attacking by air, may use three main types of bomb, either separately or in combination.

I. GAS BOMBS.

These are likely to be used against South Africa for the following reasons:

- (a) As they are of light weight large numbers can be transported over great distances.
- (b) They have a demoralising effect where no protection exists. (e.g.: Note the use by the Italians of this type of bomb in Abyssinia.)

The likely area of use may be assumed to be the centres of the larger cities and the congested Native townships adjacent to these and to the gold mines.

The following provisions against gas attack may be mentioned:

Anti-Gas Respirators for the sections of the population mentioned above; the gas-proofing of shelters of converted or newly-constructed types; the setting up of organisations for decontamination and treatment within affected areas.

2. INCENDIARY BOMBS :

These are of three types :

- (a) Medium case intensive type.

This type of bomb penetrates and sets fire to buildings.

- (b) Heavy case intensive type.

Used against solidly constructed fortifications.

- (c) Medium case scatter type.

Used against readily combustible materials.

The following measures can be taken against the effects of incendiary bombs :

- (i) Introduction of as many fire-resisting materials into new and existing constructions as practicable.
- (ii) The protection of existing materials by the application of various liquids and coverings.
- (iii) Organisation of fire services to cover adequately all regions likely to be affected.
- (iv) The provision of additional individual units of fire-fighting equipment.

3. HIGH EXPLOSIVE BOMBS :

This is the most likely type to be used in bombing objectives in South Africa. The weight of these bombs ranges from 50 to 1,000 kgs. This type is sub-divided into two broad categories :

- (a) Percussion type embracing Fragmentation, Demolition, and General Purpose bombs.
- (b) Delayed action type embracing Armour-piercing and Semi Armour-piercing bombs.

The general effects of these bombs are Blast, Shock, Impact, Penetration, Splintering, and damage by falling debris.

The measures to be taken against these effects are dealt with in later sections in this report.

Bombardment from warships is an additional form of attack which must be allowed for at important coastal towns (Capetown, including suburbs up to Simonstown, Port Elizabeth, East London and Durban).

The military defence measures are in this case the counter-attacking element. The effect of sea bombardment may be assumed as far as civilian population is concerned as producing similar effects to those of aerial bombardment but with a lower destructive coefficient.

Protection should follow in the main the lines indicated to cope with aerial bombardment. If these latter precautions are comprehensive they will adequately guard against any attack from the sea.

DISORGANISATION BY SABOTAGE, LANDING OF ENEMY PARACHUTISTS, ETC. :

The existing military and police organisations at present serving the whole of South Africa, together with recently set up bodies such as the Police Reserve, should receive special training to deal with armed parachutists, sabotage and fifth column elements.

It is recommended that important industrial, shipping, administrative and military areas should be further protected by the creation of surrounding belts zoned into relatively small areas in which a military personnel would be set up to form a closely knit whole. These belts would serve the additional purpose of providing in some measure means of detecting approaching enemy aircraft and communicating warning thereof. The depth of these zones and their distance relative to the areas they protect are dependent on such factors as :

- (i) The time limit of air raid warning to be aimed at.
- (ii) The limit of available personnel and equipment.
- (iii) The extent to which it is desirable that lines of communication between large centres should be covered by the system.

OBJECTIVES FOR ENEMY ATTACK BY AIR :

(Note: See first report, page 324, for enumeration of objectives.)

The objectives in South Africa as set out in the first report may be subjected to detailed analysis. These objectives, as visible from the air, can be effectively studied and evaluated with the assistance of the air authorities on the basis of the existing aerial surveys.

The factor of danger relating to the various objectives set out in one category must be closely considered in relation to other categories having different coefficients of danger. For example, in the greatly increased risk of destruction incurred in a suburban area contiguous to an important industrial centre. Two cases of this existing condition may be cited :

(a) The residential areas of Johannesburg which border on those Gold Mines which run through the city;

(b) The crowded quarter adjacent to the Railway workshops at Salt River, Cape Town.

Rail and Road communications are limited in number and capacity so that they offer obvious objectives where dislocation of services with resulting confusion is aimed at by the enemy.

Although the military authorities would be primarily responsible for the safety from aerial attack in training camps, staff headquarters, etc., any system adopted for A.R.P. measures should be taken advantage of and utilised where practicable.

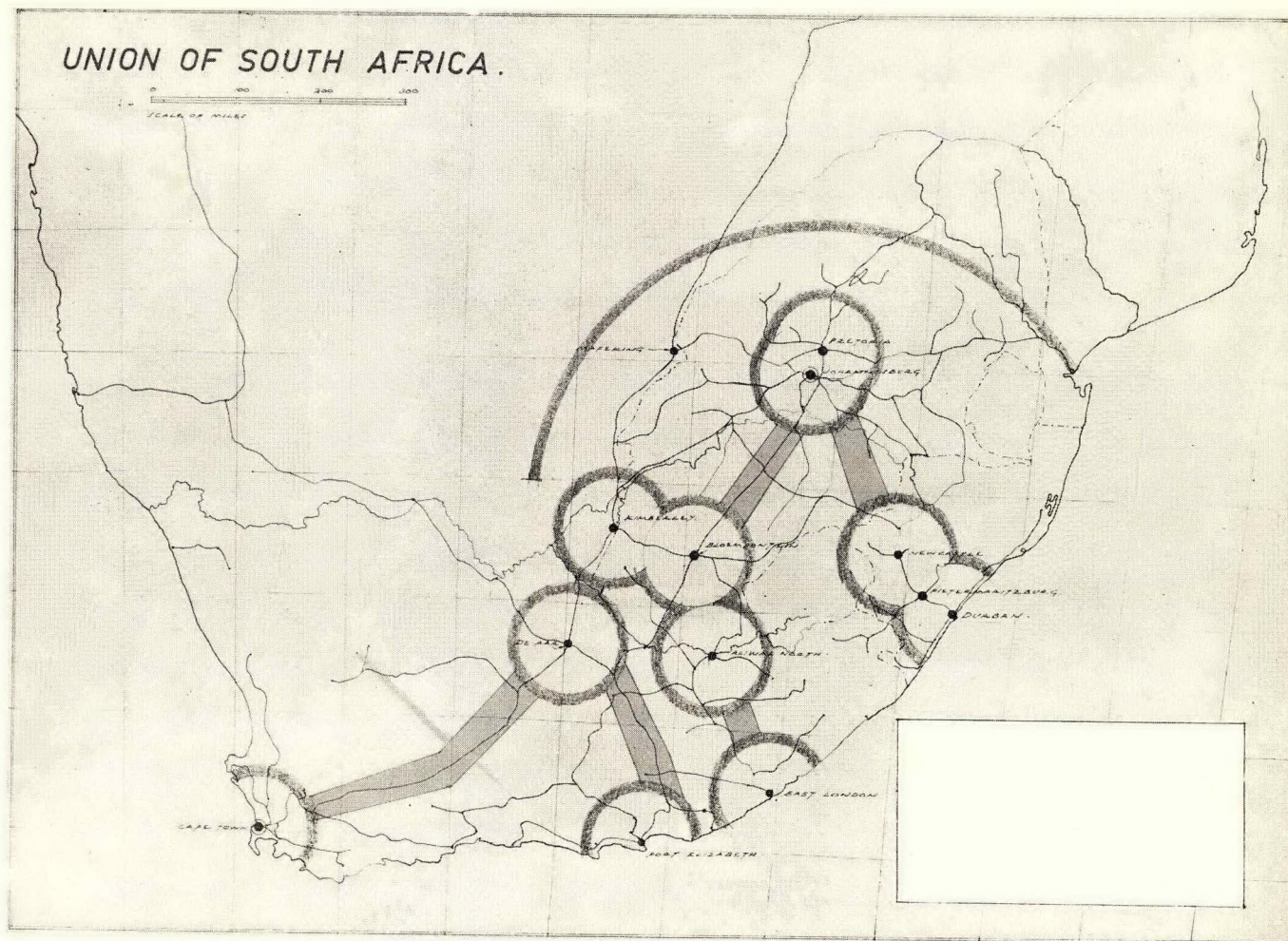
MEASURES :

Analysis and Recommendations.

It has been established that the most likely means of attack to be anticipated as far as aerial bombardment is concerned is by the use of light to medium weight high explosive bombs of different types, with a limited use of incendiary bombs. In addition the probability that gas bombs would be used must be stressed since no provisions against this form of attack exist at present in South Africa. As a first general measure it is most strongly recommended that anti-gas respirators be provided in the first place for the urban population, including Natives. The latter group must be brought under equal protective measures as those applied to the European population. This equality of protection involves one of the first principles of effective A.R.P. Particularly in the case of Natives confidence in protective measures provided by the Authorities is an essential factor in preventing the spread of panic and general confusion.

MILITARY PROTECTION :

Further to the points mentioned under the same heading in the first report, attention must be drawn to the urgency of arranging methods of warning to the civilian population against air attack. The necessary



This map illustrates diagrammatically a method suggested by the A.C.C.D., of warning important centres against the approach of enemy aircraft. Zones of appropriate position and area around each centre and along important lines of communications would be established. Within these zones would be located suitable posts for telephonic or other means of contact with the centre concerned.

arrangements for this would be strictly in military hands. It would be necessary in the first place to determine the time limit of warnings. The actual methods of warning would necessitate the use of sirens whose effective range would determine their placing, and, in addition, mine and factory hooters could be similarly employed.

PRESERVATION OF ESSENTIAL SERVICES, INCLUDING LIGHTING RESTRICTIONS :

Essential services comprising the production of power, the supply of water, and the maintenance of civic amenities such as transport systems, lighting, sewerage, etc., must be protected as far as possible, and where practicable alternative methods of service must be made available.

The vulnerability of South African electrical supply systems and water services is one of the most serious factors that demands immediate measures. The dislocation of either of these in a densely populated region would result in incalculable damage and extended disorganisation over a wide area. These factors are just as likely to cause serious damage, casualties, and panic as would result from direct hits on the civil population. The setting up of well-organised repair and maintenance squads, able to deal with the widest range of emergencies and thoroughly familiar with the location, type and function of all services is a vitally important step.

Decentralisation.

It is desirable to break up the large personnels in public services by removing them to points situated in areas less likely to form an objective for enemy attack. This would serve to decongest the areas in which they are normally situated and would insure the safety and continuity of the services and the records pertaining to these.

Industrial Undertakings.

As far as these are concerned widely distributed units of production should be established in which single elements of any particular military or civil commodity are manufactured rather than the complete item in one place, thus ensuring the continuity of supply.

Services such as radio and telegraphs should be duplicated to maintain contact throughout the country.

Auxiliary lighting and other plants should be set up where possible to serve such organisations as hospitals, etc., where these do not already exist.

Similarly alternative road transport should be organised to replace the normal railway system in the event of damage by bombing.

Storage depots of rolling stock, petrol, foodstuffs, and other essential commodities should be categorised and protective means such as camouflaging be immediately undertaken.

LIGHTING RESTRICTIONS :

Drastic action with regard to lighting restrictions is one of the most important precautionary measures to be taken against air attack. The items of prohibition and restriction covered in the pamphlet on War-time Lighting Restrictions issued by H.M. Stationery Office in England may be taken as a general guide for South African application, and the methods quoted therein may be followed in general principle.

Total prohibition or restriction of light from the following sources must be considered : Private homes, shops, business premises, places of entertainment; advertisement lighting and illuminated signs; factories and industrial premises; street lighting; lighting for essential services; road vehicles; railways, shipping, navigation and aircraft lights.

EVACUATION :

The evacuation of certain elements of the civilian population is a preparatory measure undertaken at an early stage of an A.R.P. scheme. This measure can only be put into operation if directed, co-ordinated and controlled by Government authority. This is apparent for the following reasons :

If it is intended to proceed with evacuation on a voluntary basis it would be necessary to convince the public of its desirability. This is possible by the employment of collective propaganda, reaching all

parts of town and country. This can only be carried out by the highest authority, namely the Government.

In the actual steps to be taken for evacuation measures, whether the movement be voluntary or compulsory, a controlling body having jurisdiction at points of dispatch and reception must be established. In this respect local authorities, by the restricted nature of their field of operation, would be inadequate to meet the requirements.

Evacuation entails the removal of non-active and juvenile sections of the population, especially those living in congested areas, adjacent to possible enemy objectives. The process of evacuation lessens the possibility of casualties among the sections removed, and at the same time considerably increases the safety factor of any protective measures which are undertaken for the remaining portion of the population.

Two processes are involved in the carrying out of evacuation. These are :

- (1) The assessment and removal of the elements to be evacuated.
 - (2) The selection and preparation of reception areas.
- (1) This section (assessment and removal) is comprised principally of :
- (a) Children (approximately 5—15 years of age).
 - (b) Mothers with babies.
 - (c) The Aged and Infirm.
 - (d) Hospital patients.

Regarding these in the order named, it is suggested :

- (a) That whether evacuation be compulsory or voluntary the personnel of individual schools would be removed en bloc. The teaching staffs could be in charge of each such school.
- (b) It is undesirable to separate children under six years from their mothers. This necessitates the joint removal of mothers and babies. This process could be carried out with the aid of Women's Organisations, Religious Organisations, the Red Cross Society and the St. John's Ambulance Brigade.
- (c) In general A.R.P. measures are designed for use by able-bodied persons. It is therefore desirable to remove the aged and infirm to places of relatively greater safety. Complete evacuation of this section should if possible be aimed at. The aid of organisations accustomed to handling

this class of persons could be enlisted in this case.

- (d) The responsible staffs of hospitals and nursing homes would determine how far it would be possible to free their institutions of those patients able to be moved. Such a step is necessary in order to ensure the greatest possible accommodation for severe air raid casualties. The personnel carrying out the removal would include hospital and university medical staffs, voluntary first-aid associations and medical students.

General Note on Transport for the Above.

A factor affecting the whole scheme is the means of transport. If the measures are carried out well in advance of possible disruption the South African Railways and Bus Services would deal with the transport requirements. In case of emergencies, however, additional motor transport service must be provided. This will be largely made up of fleets of privately-owned motor cars, whose drivers will be organised and trained for such duties.

- (2) This section (selection and preparation of reception areas) necessitates a progressive programme. The first step to be taken is a national survey of possible regions where evacuation may be conveniently undertaken from densely populated areas. The suitability of such districts depends upon their remoteness from possible attack, or from internal disturbance; their amenities such as climate and aspects; the light, water and sanitary facilities; accessibility to communications.

This will be followed by a survey of existing accommodation in these regions. It is recommended, however, in the light of existing rural conditions in South Africa, that the creation of purpose built accommodation be considered as an immediate measure.

The urgency with which these collective dwellings may be required necessitates the immediate issuing of instructions to Architects to put the work in hand. The Architect's familiarity with current building methods and materials would be essential for the speedy, efficient and economical construction of such semi-permanent units.

In this process the Architects would bear in mind the likely conversion and use of such units to peace-time purposes such as children's holiday camps, sanatoria, rural educational centres.

Simple air raid precautionary measures such as the excavation of trenches would form an integral part of these building programmes,

THE METHODS OF DETAIL PLANNING AND CONSTRUCTING EVACUATION CAMPS IN RELATION TO THE ARCHITECT.

Factors to be considered in selecting individual sites for camps are topographical character, nature of soil, prevailing winds, rainfall, etc. The natural camouflage afforded by kloofs, kopjes, trees, etc., must be fully exploited. In terms of these considerations it is recommended that an informally arranged scheme moulded to natural contours and conditions will offer a greater degree of safety than a more geometrical layout, which, though perhaps more convenient from the point of view of economy and service, would tend to present a more conspicuous target when seen from the air.

In planning the camps themselves it should be the aim of the Architects to limit the number of persons housed in one unit so that the whole camp is made up of a series of separated units within easy walking distance of a central service and administrative nucleus.

The type of accommodation arrangement is a matter for detailed consideration elsewhere, though it must be borne in mind that due account must be taken of seasonal changes of weather.

A characteristic selection of sites to deal with evacuation from the Witwatersrand area would be the northern ridge of the western section of the Witwatersrand and the regions of Rustenburg kloof and Olifantsnek, all of which satisfy the conditions set out above.

A general survey of available sources of material and manufacturing processes (both in war-time industry and on the sites concerned) should be undertaken with a view to establishing the most economical and efficient general system of construction. Pre-fabricated standardised elements offer the most economical and practical general method of construction for such collective dwellings.

ADMINISTRATION :

The existing system of dividing the country into magisterial districts indicates an administrative machinery which can be utilised for the control of evacuation camps. Under the magistrate's direction and with the co-operation of the district surgeon and of the members of Town or Village Councils, medical attention, transport and essential services would be provided. The administration of the camps themselves would naturally fall to the teaching staffs accompanying the children. In the case of camps for other classes of evacuee corresponding arrangements for administration and control would be made,

CONSTRUCTION OF SHELTERS :

The following effects of high explosive bombs should be taken into account in considering the construction of bomb-resistant shelters :

- (a) Impact : The velocity of a falling bomb can vary under different conditions from 400 to 1,500 feet per second. The energy so produced is used up in causing strain stresses and heat in the materials resisting the impact. Total destruction is likely to arise in the immediate vicinity of the impact.
- (b) Penetration: The penetration is dependent firstly upon the weight, speed and angle of impact of the bomb; and secondly on the nature and resisting properties of the material affected. The release mechanisms may operate immediately on impact or be delayed so that the explosion can take place after partial penetration with consequently greater damage below the surface.
- (c) Shock : If the explosion occurs in a hard material such as earth or concrete a shock or pressure wave will be set up in the surrounding material. The effects of this action are the disintegration and destruction of the material penetrated, the radius of effect varying according to the nature of the materials. The resistance offered will affect the distance along which destruction will take place. Walls of basements and trenches, and foundations beyond these limits are likely to be disturbed by the pressure set up by the explosion.
- (d) Blast : When the explosion takes place in the open air a pressure impulse is propagated in the surrounding atmosphere and this is followed by a negative impulse. This pressure and suction can cause collapse of structures at considerable distances from the point of explosion.
- (e) Splinters : Fragments of the bomb are scattered in all directions after explosion, and as these fragments have a high velocity considerable damage may result over a large area.
- (f) Falling Debris : Debris is of two types. Firstly, the shattering of surfaces with the effect similar to that caused by splinters, and secondly falling debris caused by the collapse (partial or complete) of buildings.

Factors in the Design of Protective Shelters.

For the purpose of establishing the most suitable type of shelter for any particular urban area under South African conditions the following factors must be taken into account ;

A SOCIAL AND ECONOMIC CONSIDERATIONS :

The extreme limits to which protection can be taken may be symbolised at one end of the scale by the individual able to construct at his own expense a shelter for his family within his property. At the other end the slum dweller living in a congested area, for whom commensurate protection must be undertaken and completely financed by the public authorities. Between these extremes lie the graded cases which call for partial subsidisation by the authorities and proportional contribution by the individual. As A.R.P. is essentially a public undertaking, the maximum contribution that each class is able to make should be pooled so that an equal degree of protection from danger be provided for all.

These measures must naturally allow for the protection of Natives, Indians and Coloured Persons. Each of these sections constitutes a complex problem for which special treatment is required.

B DENSITY OF POPULATION as a factor in placing various types of shelters in given areas.

This factor decides the type of shelter to be adopted in any particular area. Where the density is low, such as in certain residential suburbs, and sufficient free space exists, the individual can either construct a shelter for his family needs, or he may combine with his neighbours in constructing one shelter to house the members of their combined households (half acre stands and upwards).

Where it is not feasible (for reasons shown on the accompanying drawing No. A.C.C.D.3) to arrange individual shelters (one-eighth to quarter acre stands) communal shelters for each block of stands offers the only really practicable solution. This method includes in general the needs of small industrial units.

Where the density is high (e.g., business areas, shopping areas, industrial areas, crowded residential areas, and slum areas) the impossibility of obtaining sufficient space for the construction of separate shelters leads inevitably to the adoption of large capacity shelters at selected points. Lastly, the question of movement of population within wide areas requires minute analysis so that ample provision can be made to protect elements in transit.

C THE FACTOR OF DANGER :

The factor of danger for the individual is directly dependent upon the proximity of any given area in which he is placed to potential objectives for enemy attack. This factor will vary from a very low risk on the outskirts of large cities (where are normally situated widely-spaced and separate houses) to an extremely high degree of risk where the housing accommodation is adjacent to known objectives such as railways, mines, factories, etc.

And again on the risk naturally arising from overcrowding of dwellings, inferior methods of building, lack of open spaces; and the inevitably high density of office and shopping areas.

We may now consider this question of the factor of danger in greater detail :

The first process is to establish coefficients or relative standards of safety with regard to the individual. The findings in connection with this factor of safety have already been tabulated by research undertaken by Messrs. Tecton, Architects, of London, and are based upon all available technical information on the known effects of bombs.

Considering the effects of blast we may proceed as follows :—

Assuming an individual to be standing in the open, it has been computed that a 100 kg. bomb falling anywhere within a circle having a radius of 104 feet would prove fatal to him. On the other hand it is probable that a bomb falling at 200 feet or further from the individual would have no effect. Between these limits, namely 104 feet and 200 feet, the danger is graded from 100% to 0%.

By graphical methods the volume of danger can be shown under various conditions.

In the case of splinters the limits of danger are 100% at 50 feet to 0% at 350 feet.

The danger factor of blast and splinter effects combined can be shown graphically, and assuming a general-purpose bomb of 500 kgs. the limits of danger range from 100% at 230 feet to 0% at 650 feet. There is in fact a considerable decrease in possible risk towards the outer limit of danger volume.

The graphical method can be similarly employed to determine the relative safety provided by various types and sizes of shelter. Shelters can therefore be designed with a full knowledge of the comparative safety which each type will provide. In actual design careful analysis of the strengths

of wall and roof has to be made so that these elements can be combined in the most efficient and economical manner.

It is obvious that no absolute assumption as to the exact type and weight of bomb to be used by the enemy, nor the number dropped within a given area, can be made. A composite-average bomb is therefore taken as a basis for all calculations concerning shelters. By a mathematical process the "danger-coefficient" of the shelter can then be arrived at, and this will give a direct reflection of the occupant's chances of survival.

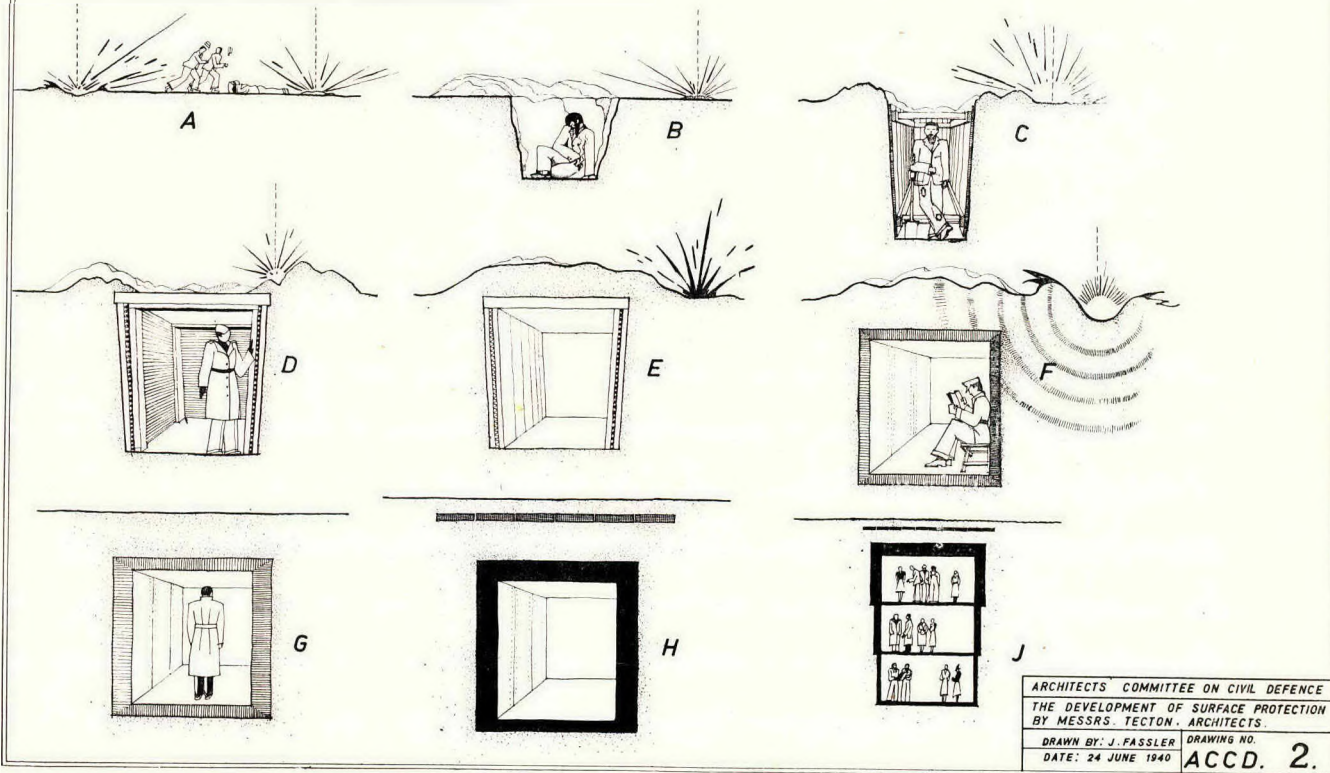
Before referring to the types of shelter suggested for use in South Africa, and which are illustrated by diagrams accompanying this report, it will be necessary to study and evaluate the various types of protection that can be afforded by modern technique.

Sheet No. A.C.C.D. 2, which is based upon that prepared by Messrs. Tecton, illustrates diagrammatically the development of the shelter sunk into the ground.

(a) Shows the individual completely exposed to the dangers of bombing, and (b) shows that he would considerably reduce the risk of destruction by digging a hole in the ground. This would protect him from almost all effects except that of a bomb falling directly into the hole. The sides of the hole, however, are liable to cave in if no steps are taken to prevent this, and (c) shows the use of light timber strutting to provide this support. The next step is to provide a more permanent form of support to the earth, and this is given in (d), where corrugated iron sheets held in place by timber struts form walls. This, in combination with a thin roof covering, will keep the trench relatively dry. In (e) the walls and roof are strengthened so as to exclude small pieces of debris, but these measures are not yet sufficient to protect the trench from shock waves caused by bombs falling nearby. At (f) the trench is lined at top and sides with a light layer of concrete which will afford some protection from shock waves in the earth.

(g) Is a more solid construction with a layer of earth above the roof, and in (h) a separate detonating slab is introduced above the heavy roof slab as an added protection against bombs falling directly over the trench. (i) Offers the same type of protection, but in this case one roof covers several floors one below the other. This is an economical arrangement, as the costly bomb-proof roof protects a high number of persons per unit area.

THE DEVELOPMENT OF SURFACE PROTECTION.
BY MESSRS. TECTON ARCHITECTS.



For an explanation of the above diagram the reader is referred to the detailed discussion on the opposite page.

FORMS OF SHELTER :

The forms of shelter with which it is proposed to deal are as follows :

- (1) Trenches.
- (2) Surface Shelters.
- (3) Converted Buildings.
- (4) Tunnels.
- (5) Bomb-proof Shelters.

(1) TRENCHES :

The trench is the simplest known form of protection and can consist of long narrow corridors in a crenellated or chevron layout.

The resistance of the side walls to shock can be increased progressively by the employment of concrete linings, varying in thickness from 3 inch pre-cast concrete to 9 inch reinforced concrete cast in situ. The degree of safety for a 6 inch reinforced concrete wall is almost twice that of a 3 inch pre-cast wall, while a 9 inch reinforced concrete wall only slightly improves on the safety of a 6 inch reinforced concrete wall.

Trench systems in general offer serious practical disadvantages from the point of view of planning and actual functioning. It is obvious that a trench system could not be applied to congested areas where open spaces are at a minimum; and it is submitted that the trench system is not even feasible in most suburban areas of large South African towns.

It may be noted that according to British standards it is possible to accommodate 1,780 persons per acre in trenches. This allows 3.50 square feet (1 ft. 9 in. x 2 ft.) per person. This figure would result in overcrowding and in general it is desirable to allow 6 square feet per person.

The problems of control and circulation, the practical difficulties of waterproofing, drainage, lighting, ventilation, gas-protection, etc., render the use of trenches a measure of doubtful value.

A careful and architectural interpretation of the trench system, having due regard to ease of movement and access to essential elements (e.g., closets and first aid) can offset many of the disadvantages, but their inherent weakness should always restrict their general use.

The ARUP system, for example (illustrated on the accompanying sheet, No. A.C.C.D. 4) gives a greatly increased degree of safety and practicability, though it is not suitable for use by large numbers of persons. This form of trench should be considered in industrial regions where comparatively limited numbers of people are engaged to work in groups.

(2) SURFACE SHELTERS :

The surface shelter (one layer of accommodation immediately below ground level) is a natural development of the trench system, but the disadvantages inherent in the trench system are largely eliminated. By combining the trenches into a more compact arrangement and by replacing the mass of earth between trenches by reinforced concrete walls of suitable strength it is possible to evolve a type of shelter giving free circulation and convenient access to all necessary services. The internal walls serve as baffles to confine the effects of blast and splinters resulting from direct hits. The risk of danger of this type of shelter is half that of the general trench system mentioned above. The risk may be even further reduced by thickening walls and roof slab. This strengthening should be aimed at provided economic considerations permit.

Further advantages in this system are :

- (a) It allows adequate gas-proofing.
- (b) A great number of persons per unit area (4,000 persons per acre).
- (c) The shelters are readily convertible to peace-time uses such as car parking, storage, etc.
- (d) The construction employs economic current building methods in South Africa.
- (e) It permits ease of control at points of entry.
- (f) It provides ready means of alternative escape.

In general it follows that the surface shelter affords the most suitable type of protection for densely populated areas when :

- (1) A short-term programme is aimed at; and
- (2) When economy is a first consideration.

The surface shelter is therefore especially applicable to the urban regions for the larger South African towns.

(3) CONVERSION OF EXISTING STRUCTURES :

Generally the typical basement in town buildings cannot be considered a suitable refuge from air attack unless considerable structural and other alterations are undertaken. The danger of collapse is lessened in many new buildings as a result of the use of reinforced concrete or steel framed structures. This factor, however, must not be assumed to provide resistance to the passage or destructive effects of bombs.

No doubt in many cases the superimposition of a number of floor slabs above the basement will retard the effect of bombardment, but even allowing for this factor the converted basement must in all respects comply with the code requirements of surface shelters.

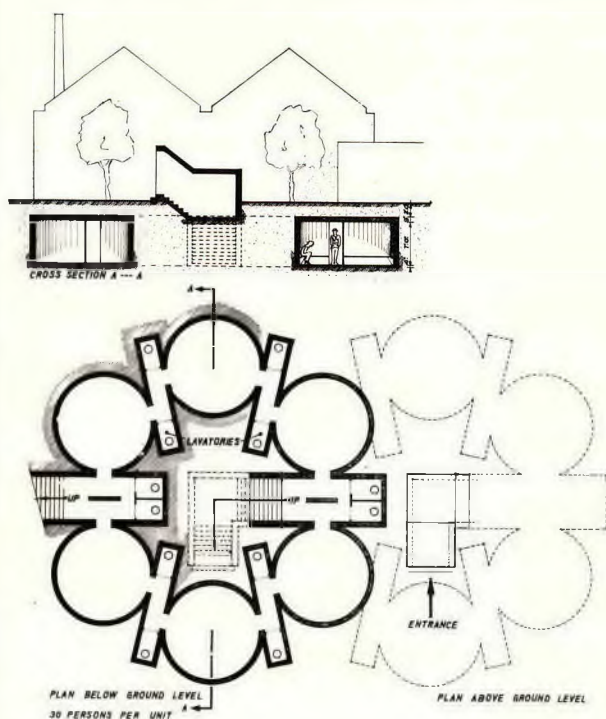
The following steps must be undertaken in any conversion :—

- (i) Strengthening of external walls and the treating of pavement lights, etc.
- (ii) Construction of new ceiling slab.
- (iii) Isolation of all service pipes (e.g., gas, electric, sewer, etc.).
- (iv) Reduction of floor areas into small spaces by the introduction of reinforced concrete baffle walls.
- (v) Provision of suitable methods of alternative escape.
- (vi) Adequate means of ventilation.
- (vii) Provision of sanitary accommodation.

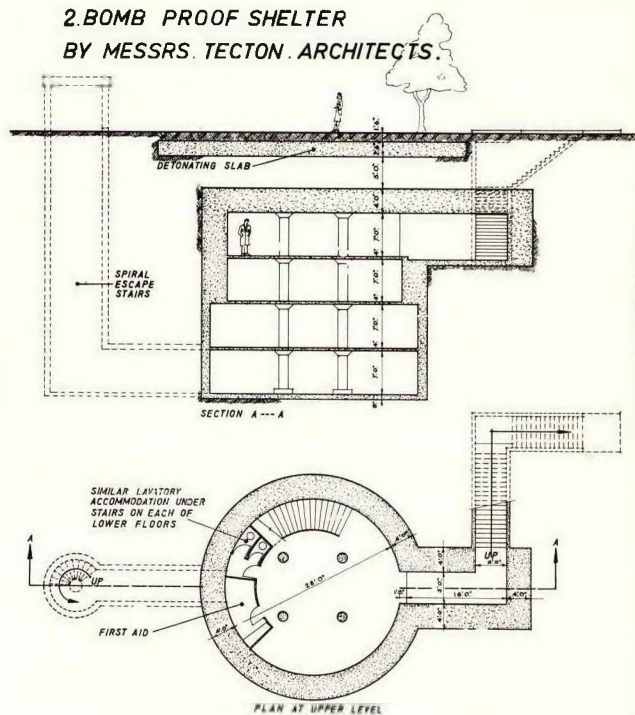
(4) TUNNELS :

Where the physical nature of the site permits tunnels offer an ideal form of immunity from bomb attack. Constructionally, tunnels require to be lined, but otherwise the volume of earth above them serves as an excellent protective element. (Fifty feet depth of earth is the minimum superimposition required for safety.)

1. SHELTER BASED ON THE "ARUP" SYSTEM
FOR INDUSTRIAL UNITS & INSTITUTIONS.



2. BOMB PROOF SHELTER
BY MESSRS. TECTON ARCHITECTS.



ARCHITECTS' COMMITTEE ON CIVIL DEFENCE	
1. SHELTER BASED ON THE "ARUP" SYSTEM FOR INDUSTRIAL UNITS & INSTITUTIONS	
2. BOMB PROOF SHELTER BY MESSRS. TECTON ARCHITECTS	
DRAWN BY W. D. HOWIE	DRAWING NO. .
SCALE 1" EQUALS 3' 0"	DATE 24 JUNE 1940
	ACCD. 4.

1. The type of shelter illustrated in figure 1 above has been evolved to meet the requirements of industrial or commercial units where a high degree of concentration is necessitated. Approximately 4,000 persons can be accommodated per acre in this system which also provides a relatively low danger factor.

2. Fig. 2 shows a shelter designed by the Architects Tecton to accommodate 270 persons. It must be noted that this shelter can be considered "bomb-proof" according to known data and experience relating to the heaviest aerial bombardment.

The advantages offered by tunnel protection are :—

- (i) Minimum exposed surface area required.
- (ii) In many South African towns the contours of certain districts encourage the use of this form of shelter.
- (iii) The real possibility of utilising the knowledge and experience of mining engineers from the gold mines of the Witwatersrand.

The disadvantages incurred are :—

- (i) Exceptionally heavy cost of construction.
- (ii) Difficulty of ventilation, sanitation and the placing of medical posts, etc.
- (iii) Complication of layout required to provide alternative escape.

On the whole tunnelling tends to be a long term measure and has only a very limited range of application.

(5) BOMB-PROOF SHELTERS :

Multi-storey bomb-proof shelters are the logical solution for the complete protection of the civilian population. The accompanying diagram shows a small shelter to hold 270 people, designed by Messrs. Tecton, architects. The cost of erection is high, and under the present circumstances in South Africa it is unlikely that the construction of such a type of shelter could be undertaken, except in rare cases.

PLANNING, DESIGN AND CONSTRUCTION OF SHELTERS IN SOUTH AFRICA

In combination with the factors previously established, the following further considerations will influence the design of constructed shelters.

The placing of shelters within a given area is directly dependent on the practicable limit of distance (in terms of warning time) of the furthest potential occupant from the shelter. This distance should not exceed a quarter of a mile (six minutes walking time).

The type of shelter is governed by the number of persons in any particular area to be housed in an emergency.

To satisfy the above conditions three general types of shelters have been planned by the Architects' Committee on Civil Defence :

- (1) Individual or limited family shelters for low-density areas.
- (2) Communal shelters for each block of stands, where the available free space is restricted.
- (3) Large capacity shelters for high-density and congested areas.

Bearing in mind that an equal coefficient of protection must be provided for every individual, each type of shelter should conform to the following provisions :

- (a) Adequate entry and egress.
- (b) Prevention of flooding.
- (c) Sanitary accommodation.
- (d) System of lighting.
- (e) Ventilation. (Note : Gas-proofing is only practicable in large capacity shelters).

Considering the three general types of shelter listed above in order, we have :

- (1) The individual or limited family type cannot be economically constructed to conform with the requirements scheduled immediately above, and should only be considered where the possibility of danger is remote.

- (2) A communal shelter is shown on the accompanying drawing No. A.C.C.D. 3, applied to an average Johannesburg block of sixteen stands. This design has been evolved to suit conditions prevailing in residential areas of medium density. The required accommodation of each shelter is arrived at by assuming an average of four European persons and two Natives for each household. As the total number of persons to be accommodated is thus 96, two shelters (each holding 48 persons) have been placed, one at each end of the block.

The shelters are placed outside the boundaries of the block and below the level of the adjoining pavement. This has been done since the area available within each block of stands is restricted and varies from block to block in shape and distribution.

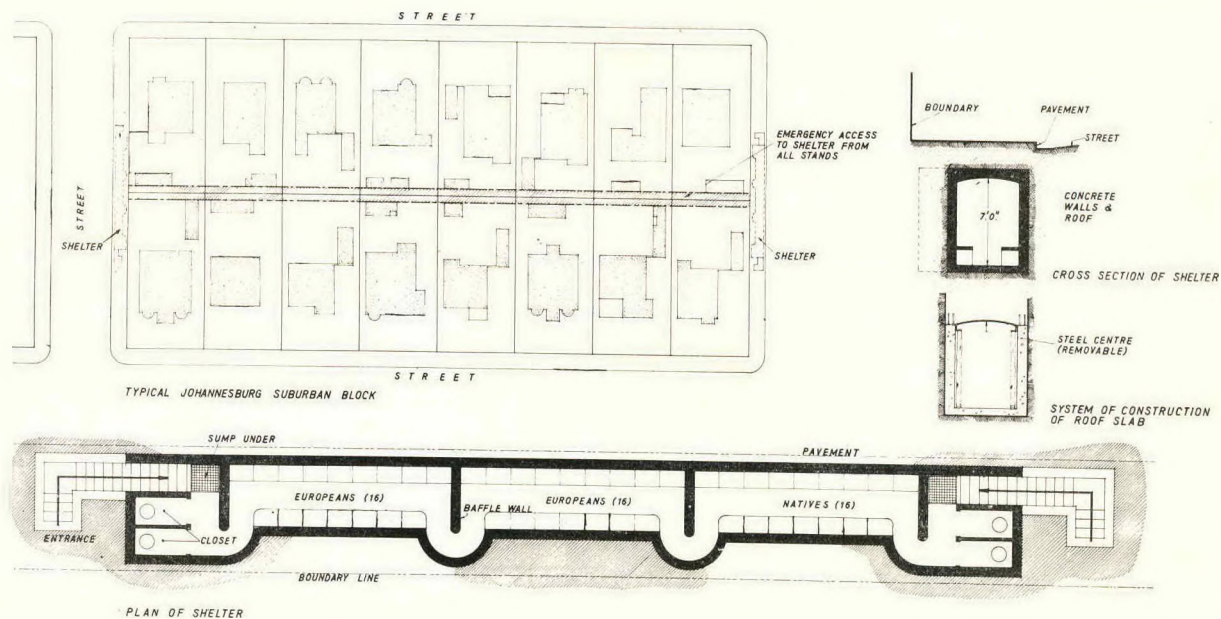
This type of shelter has been designed with access stairs at each end, one entrance for Europeans and the other for Natives, with baffle walls between the two sections. Through access is maintained for emergency should either entrance be obstructed. Two chemical closets have been provided at each end. The walls are to be 9 inches thick built in concrete (4 : 2 : 1) cast in situ, reinforced with steel to minimise the danger of collapse due to pressure or shock. The floor is to be in concrete 6 inches thick laid on a hard-core base and drained to a sump from which seepage or rain water can be pumped. The ceiling is to be 6 inches thick reinforced to carry a suitable layer of earth filling above.

- (3) A large capacity shelter has been evolved for South African use in conformity with the principles established earlier in this report. Such shelters would naturally be placed in congested areas and may necessitate the demolition of existing slum property. The size and shape of the proposed shelter has been arrived at with this factor in mind.

In the case of densely populated urban areas full use would have to be made of whatever open spaces exist, and the capacity and dimensions adjusted to meet the conditions.

The shelter illustrated in the accompanying drawing, No. A.C.C.D. 5, has been designed to accommodate 2,000 persons, and has been developed as a standard type suitable for the purposes mentioned above. This design provides accommodation for the public in two units of 1,000 each, with two main access staircases and service facilities between the wings. Four emergency entrances

SHELTER SUITABLE FOR SUBURBAN AREAS



ARCHITECTS COMMITTEE ON CIVIL DEFENCE	
SHELTER SUITABLE FOR SUBURBAN AREAS	
DRAWN BY J. PASSLER SCALE 1" EQUALS 4'0" DATE 24 JUNE 1940	DRAWING NO. ACCD. 3.

The above scheme has been designed by the A.C.C.D. for use in suburban areas of medium density of population in large South African towns. Study of typical blocks of suburban stands will show that the arrangement of houses and outbuildings is unfavourable for the building of single or group shelters within the boundaries of the stands.

The pavement shelters offer the advantages that: (a) they are common to all the houses in a given block; (b) they are accessible to moving elements of the population; (c) their position below ground level allows uninterrupted use of the pavements; (d) they provide a convenient arrangement for the accommodation of householders and their servants, in that a reasonable degree of separation and of contact can be maintained.

or exits are provided, one at each corner. Between the units is placed a First Aid station easily accessible from each unit and from the main approaches. Below this centrally placed First Aid station, air-conditioning, lighting and pumping plants are housed.

Lavatories in each section and for both sexes are provided. A portion of this type of shelter would be zoned for the accommodation of Natives.

The shelter is to be constructed with 12 inch reinforced concrete external walls, 9 inch internal reinforced concrete walls and baffles, 9 inch thick reinforced concrete roof. The central entrances and emergency First Aid section would be provided with a bomb-proof roof with an independent detonating slab above.

ORGANISATION OF CIVIL DEFENCE FOR THE UNION OF SOUTH AFRICA

Reference to this aspect of the problem of Civil Defence was made in the first report (page 325), but the matter is of such a complex nature that it has been considered desirable to plot the complete personnel and indicate the function of each department on a chart. For information on this subject it will prove more convenient to refer directly to this chart (Drawing No. A.C.C.D. 6) than to attempt to follow an extended description.

This report, which aims at covering the general background to the problem of civil defence, and which also throws light on many of the technical issues involved, must by the nature of its voluntary submission have left many detailed considerations for future attention. Nevertheless, it should be clear that a programme for positive action can easily be built up from the suggestions and recommendations embodied.

Drawn up by: Norman Hanson, B.Arch., A.R.I.B.A., M.I.A.,

and

Rex Martienssen, M.Arch., A.R.I.B.A., M.I.A.

in collaboration with Messrs.

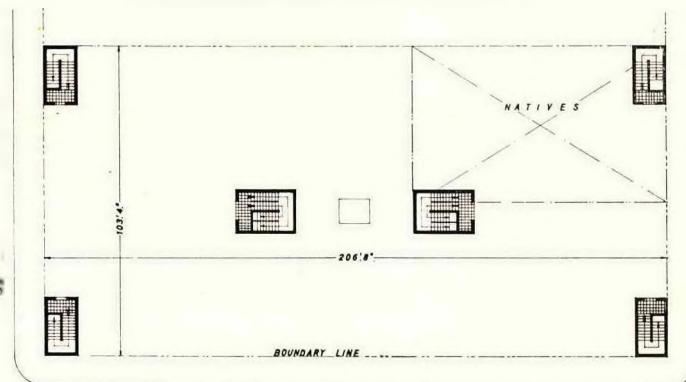
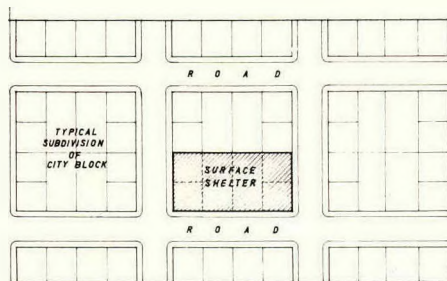
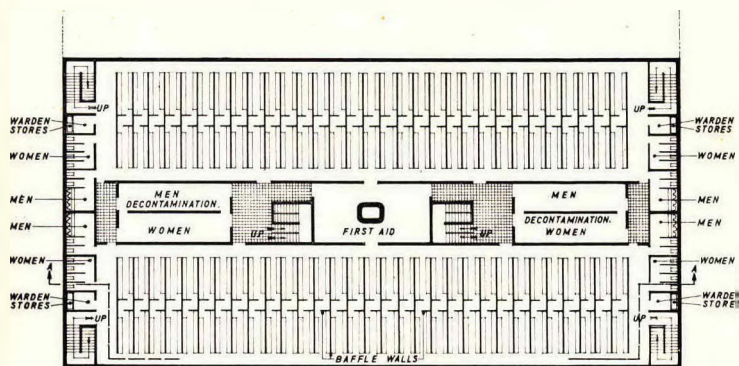
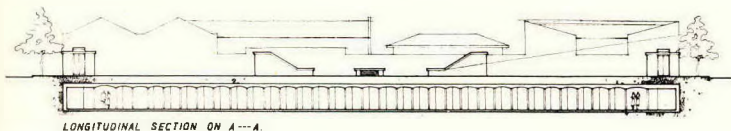
W. G. McIntosh, B.Arch., Dip.Q.S., A.R.I.B.A., M.I.A.;

J. Fassler, B.Arch., M.I.A.;

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**TYPICAL SURFACE SHELTER FOR CONGESTED AREAS
FOR USE IN SOUTH AFRICA.
ACCOMMODATION 2000 PERSONS.**



SCHEME PREPARED BY
W GORDON MCINTOSH & JOHN PASSLER
IN COLLABORATION WITH THE A.C.C.D.

ARCHITECTS' COMMITTEE ON CIVIL DEFENCE
TYPICAL SURFACE SHELTER FOR CONGESTED AREAS
DRAWN BY J PASSLER DRAWING NO.
SCALE 1" EQUALS 16' 0" DATE 24 JUNE 1940 ACCD. 5.

The general solution proposed by the A.C.C.D. for large communal shelters in congested city areas is shown above. This example would cover half a Johannesburg city block and would accommodate 2,000 persons, allowing six square feet of floor area per person. It contains also the detailed services required for all types of casualties. The system of reinforced concrete baffle walls divides the total number of occupants into small groups, thus minimising the effect of a possible direct hit. It is recommended for use in existing open sites, or in slum areas where demolition may be feasible. The location of these shelters would be dependent on such factors as density of population and range of warning for fixed and moving sections of the population.

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and with the assistance of Messrs.

H. Rothschild, B.A., LL.B.,

and

J. S. Lewis, M.I.A. (Hon.), M.C.Q.S. (Hon.),

(Registrar, Institute of South African Architects),

and submitted to

Major T. B. Clapham, M.C.,

Officer Co-ordinating Civilian Protection Measures,

by

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President-in-Chief, Institute of South African Architects,

Chairman of ARCHITECTS' COMMITTEE ON CIVIL DEFENCE.

The authors of the Reports wish to acknowledge their indebtedness to the following works on the subject of A.R.P.:—

Haldane, J. B. S. [F.R.S.], "A.R.P." Gollancz, 1938.

Tecton Architects, "Planned A.R.P." The Architectural Press, 1939.

Numerous articles on the subject in Architect's Journal, London, also in L'Architecture D'Aujourd'hui, Paris.

Ten Cambridge Scientists. "Air-raid Protection: The Facts." Fact, April, 1938.

Glover, C. W. [M.Inst. C.E., M.Inst. Struct. E., M.Inst. R.A.]. "Structural Aspects of Air-raid Precautions." Specification, 1940. The Architectural Press.

The following list shows numerically the response of the Architectural and Quantity Surveying professions to the circular addressed by the A.C.C.D. requesting assistance in the matter of Civil Defence.

Architects offering assistance:

Johannesburg	.....	57
Brakpan	.....	1
Germiston	.....	1
Krugersdorp	.....	2
Pretoria	.....	11
Durban	.....	13
South Coast (Natal)	.....	1
Newcastle	.....	1
Kimberley	.....	3
Bloemfontein	.....	2
Cape Town	.....	7
Port Elizabeth	.....	5
East London	.....	3
George, C.P.	.....	1

Quantity Surveyors offering assistance:

Johannesburg	.....	7
Durban	.....	3
Cape Town	.....	3
East London	.....	1
Pretoria	.....	2

The foregoing Reports are published in the "South African Architectural Record" with the consent of the Officer Co-ordinating C.P.S. in South Africa. The personnel of the A.C.C.D. was as follows:

Chairman: D. S. Haddon, Dipl.Arch., A.R.I.B.A., M.I.A.

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Rex Martienssen, M.Arch., A.R.I.B.A., M.I.A.

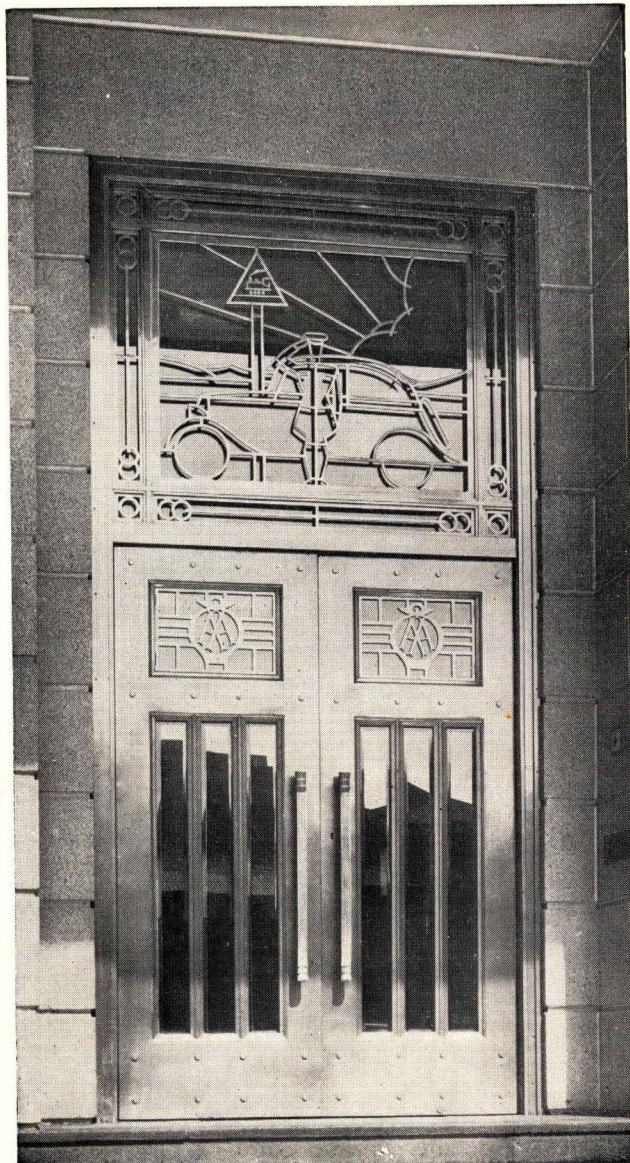
L. C. Austin, P.A.S.I., M.C.Q.S.

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