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# THE ROYAL ENGINEERS JOURNAL

## Vol LXXVIII SEPTEMBER 1964

No 3

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## Engineer-in-Chief's Address to the Annual General Meeting of the Royal Engineers on 24 June 1964

#### INTRODUCTION

#### Chief Royal Engineer, Gentlemen,

It has been customary in previous years for my predecessors to devote most of their time to giving an account of Corps activities world-wide. This year, however, has been exceptional on account of events on the home front. As you all know, there has been a major re-organization of the defence departments in Whitehall. In connexion with this re-organization there have been certain developments, notably as a result of the recommendations of the Nye and McLeod Committees, which are going to have, or could have, a profound effect on the shape of the Corps and the way we do our business. Although most of you have heard a certain amount about these impending changes, they are so important that I propose to devote a good deal of my time to them this afternoon. Before coming on to them, however, I shall skim quickly round the world to give you the highlights of Corps activity in what has been once again a busy year.

#### **CORPS ACTIVITIES**

#### THE FAR EAST

Christmas Island. Starting with the Far East, and first Christmas Island. The decision to close down Christmas Island has been taken, and all troops have now been withdrawn. Although we need the manpower badly for tasks elsewhere I feel that there will be many Sappers who will be sad at the loss of this station. Certainly it has been a magnificent training ground, both for units and individual tradesmen, and the Corps has good reason to be proud of her achievements on the Island. We have in fact only just completed a major POL project and extensive works services, carried out by a CRE's headquarters, the POL Specialist Team and 20 Field Squadron, assisted of course by the resident unit, 73 (Christmas Island) Field Squadron.

Borneo. When the trouble started we found ourselves, as so often before, without any engineer reserve in the theatre and with no CRE available to post to the staff of the Director of Operations. So once again we had to rely on improvisation. As time went on our order of battle was built up, though at some personal inconvenience to many of the individuals concerned. By January this year we had established a CRE Borneo, with 68 Gurkha Independent Field Squadron from the UK, a Works Section formed partly from ESSE personnel in the theatre, and Resources staff from the UK, supported by Survey, Transportation, Movements and Postal detachments. It is fair to say that all branches of the Corps are playing their full part in the operations. The Malayan Engineers have also been working closely with us in Borneo, giving invaluable support to the operations.

Thailand. After some negotiation, Ministers agreed last November that a 5,000 ft MRT airfield should be built to the west of the Mekong River at

### THE ROYAL ENGINEERS JOURNAL

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Mukdahan, and we were told to carry out the project. The task consists of the airfield itself and construction of a hutted camp nearby. There are many problems due to the remoteness of the site, not the least of which is finding sufficient water. However the project is going well, and work on the strip is ahead of schedule. The CRE has had under command 11 and 59 Field Squadrons, and a detachment of the No 5001 Airfield Construction Squadron, Royal Air Force. Australian and New Zealand Sappers have also been taking part in the project.

#### THE MIDDLE EAST

Aden. In Aden there is an increasing demand for Sappers for a wide variety of tasks. Over the past year our main task has been the construction of "deployment camps" at Little Aden on behalf of the Ministry of Public Building and Works, for which we have set up a CRE Works with a force of one, and sometimes two, Field Squadrons from 38 Corps Engincer Regiment, with plant support. This force has done a tremendous job, but much still remains to be done. This is clearly a commitment for some time to come. In addition, we have had the normal task of supporting the Aden Garrison and the Federal Regular Army in operations in the Protectorate. Recently the increase of subversive activity led to the mounting of the Dhala Road operation, which brought with it a demand for increased engineer support. Last month 3 Independent Field Squadron was sent out to work with 39 Brigade in this operation. They have settled in quickly and are doing a great job of work, particularly in opening up motorable tracks in the very rugged mountainous country.

Other RE units operating in the Command are 13 Field Survey Squadron and the Middle East Port Squadron, both of which are doing invaluable work in their respective spheres.

The present operation is nearly over, but there is always the possibility of trouble breaking out elsewhere. Meanwhile another scheme for winning over the tribes is being considered, which involves help to the villages around the present operational area by improvements to their water supply and irrigation arrangements, and to the Federation generally by road improvement work on the important routes. It is unlikely that the PWD will be able to do much in this direction as their limited resources are already fully committed, and we are now being asked what we can do to help.

With this commitment, and the continuing demand for work in support of the Ministry of Public Building and Works, this Command too is obviously going to need all the Sapper support we can give them.

#### NEAR EAST

*Cyprus.* The emergency in Cyprus has not involved any exceptional engineer tasks, and in fact both 33 Field Squadron and 9 Independent Parachute Squadron, who went out to the Island with the Parachute Brigade and have just returned, have been employed to a considerable extent on internal security duties. The Cyprus Park Squadron assisted by 33 Field Squadron, however, took on the construction of a 3,000 ft MRT airstrip in the Dekhelia Sovereign Base Area, and did well to finish the task in three weeks, which was well below the estimate.

Malta and Gibraltar. There is nothing exceptional to report from Malta or Gibraltar.

#### BAOR

Germany. There are three events in BAOR which I should mention:-

(a) The Skopje earthquake. A party of fifty all ranks, mainly from 35 Corps Engineer Regiment, was despatched from BAOR to assist in engineer relief work after the earthquake. They supervised the erection by local civil labour of 244 Nissen huts, which are now being used as emergency housing and schools. I am glad to say the Sappers made a very good impression in Yugoslavia, and were very popular.

(b) The build up of armoured engineers. We have just started to form a second armoured engineer squadron by converting 2 Field Squadron in BAOR to an armoured role.

(c) It has been agreed that the rank of the Commander of the Engineer Group in BAOR shall be upgraded from colonel to brigadier. This is likely to happen in October this year, and at the same time 11 Engineer Group will be re-designated 11 Engineer Brigade.

UNITED KINGDOM. There have been the usual heavy calls during the past year on units of the Strategic Reserve. At this moment two Squadrons are overseas on emergency operational tours, and three others have recently returned from similar tours. A further two have been warned for moves later this year.

One new squadron was formed during 1963, 59 Field Squadron, now in the Far East, and another Squadron (60) has just become operational.

The Transportation Organization has had to meet a large number of requests for emergency reinforcements overseas, but I am happy to say that this has not prevented the Longmoor Drama Group from winning, for the third year running, the Army Drama Festival Award, this time with "The Lark" by Jean Anouilh.

The Armed Forces Postal and Courier Service has now taken over responsibility for Royal Naval mails and so has become truly three-Service.

#### EQUIPMENT DEVELOPMENT

The M2 amphibious river crossing equipment is due off production in September this year, and will then be issued to 23 Amphibious Engineer Squadron in BAOR. Centurion bridge layers have recently been issued to RAC and RE Units in BAOR.

The class 30 trackway is now in service, and is fulfilling all the promise which General Foulkes forecast for it when he mentioned it last year. Its usefulness was clearly demonstrated last autumn when a number of prototype rolls were used at London Airport to help in the recovery of a crashed aircraft from a muddy cabbage field, and it is proving its worth in a variety of ways with units in the field.

#### RECRUITING

The recruiting situation has shown an improvement in the last year, but there can be no question of reducing the recruiting effort. The intake from Sandhurst and University entry (37 and 17 respectively) gave us fifty-four officers this year, against an annual requirement of sixty-eight, which is about the same total as last year. We hope to make up some of the short fall by recruiting officers under the new Limited Service Commission scheme. Our other ranks recruiting has been going well, and reflects great credit on all concerned with the recruiting organization. In spite of the heavy run out of "6-year men" since January this year we have increased our other rank strength to the point where we are only 100 short of our target. We must, nevertheless, keep up the pressure and make sure that we reach our target in the next month or two.

#### THE EFFECTS OF RE-ORGANIZATION

MINISTRY OF DEFENCE. One of the objects of the defence re-organization is to concentrate all major defence policy, including financial policy, in the Ministry of Defence, leaving the Service Departments responsible for day to day management of their Services within the policies laid down. To achieve this it has naturally been necessary to concentrate the War Office Policy Directors in the Central Ministry. The snag, from the point of view of those that are left behind, is that some of these Directors have a considerable hand in day to day business. They have had to split their staffs, taking some with them and leaving others behind, and have to operate themselves in two orbits. This, as you can imagine, has made it difficult to get quick decisions on urgent problems and, perhaps more important, has made it more difficult for the Arms Directors to keep themselves informed of what is going on. I mention this problem, which is already with us, as it has a bearing on what I am going to say next.

THE NYE COMMITTEE. This concerns the recommendation of the Nye Committee that the Arms Directors should be removed from the War Office. At first sight this might seem to repeat the situation brought about by the Esher Committee in 1904 when it was decided that an engineer adviser was no longer required in the War Office. But there is one important difference. Whereas the Esher Committee abolished the appointment of Inspector General of Fortifications, thereby leaving the Corps without a serving head, the Army Council (now the Army Board) has decided that the present Arms Directors shall remain in being as arms advisers, and as the professional head of their Corps, but that they shall operate from outside London.

On present planning my Directorate will move to Chatham in October this year, and will set up in Southill Barracks. I am purposely not seeking accommodation in Brompton Barracks (though in fact this would be virtually impossible at the moment owing to the re-building programme) in order to make it quite clear that the E-in-C is remaining as such and will have no part in the running of the RSME or the Chatham Garrison. My staff at Chatham will consist of a Deputy Engineer-in-Chief (Brigadier), and four branches, Co-ordination, Training, Combat Development and Logistics. Most of our Corps matters are already handled at Chatham. E1 will become a Branch under the Director of Army Staff Duties in the Ministry of Defence (Army Dept), and will then be known as ASD 7. E2 has already become a Branch (AEP 7) under the Director of Army Equipment Policy. We have retained a Brigadier in the Quarter Master General's Department, who is now called Brigadier Engineer Plans, who with his staff will work under the Vice Quarter Master General. What he is called does not really matter, the vital thing is that he is still there. He and the Colonel ASD 7 are going to be key figures in the new set up.

THE McLEOD COMMITTEE. The McLeod Committee came to the conclusion as a basic principle that there should be three Administrative Corps to carry out the logistic support of the Army, a Supply Corps, a Repair Corps and a Corps to handle Transport of all kinds and Movements. Their detailed recommendations, which were submitted to the Army Council for their consideration, are concerned with the transfer of responsibilities to bring this about. As far as we are concerned they are:—

(a) That the Royal Army Service Corps should hand over all responsibilities for Supplies and POL, Barrack and Fire Services to the Royal Army Ordance Corps, and that the remaining element should amalgamate with the Transportation and Movement Control Services, Royal Engineers, to form a new Corps, to be named the "Royal Corps of Transport". It should be noted that we retain responsibility for railway and port construction.

(b) That the Royal Engineers should hand over responsibility for supply of engineer stores, ie the Engineer Resources organization, to the Royal Army Ordance Corps.

(c) That the arrangement whereby the Royal Engineers repair certain items of plant, vehicles and equipment, should be examined and, where appropriate, the responsibility should be handed over to the Royal Electrical and Mechanical Engineers.

The last point is a comparatively minor one; the other two are fundamental. It was obvious from the terms of reference of the McLeod Committee that we were going to lose all along the line, but to have lost both Transportation and Resources would be a severe blow, especially when considered in conjunction with the reduction in our Works responsibility resulting from the recommendations of the Weeks Committee in 1958 and aggravated by the take-over of the War Department Works Organization by the Ministry of Public Buildings and Works last year. It could indeed have had the effect of reducing us virtually to a "Corps of Assault Pioneers". Although constructional engineering was hardly mentioned by the McLeod Committee, from our point of view it is essential to consider the future of Works, or the professional civil engineering side of our job which we need to balance our combat engineering, together with our other functions.

When we were discussing how to handle the McLeod Committee recommendations it became obvious quite early on that, sad though we would be to lose Transportation, there was no hope of keeping this service in the Corps, for without it it would not be possible to form the new Transport Corps and the whole concept would fail. Having reluctantly accepted that, we then worked on the principle that it was more than ever important to get Works on to a proper footing. We had, as General Foulkes foreshadowed last year, been engaged for some time on a review of the Engineer Special Service Establishment, but had not made much progress as the Ministry of Public Buildings and Works, on whom everything depended, were naturally very preoccupied with their own re-organization. Now that the future of Works has been brought into the general discussion we have been able to re-open the subject at a higher level with Army Board backing, and I am glad to say that friendly discussions are now in progress with the Ministry on this very important subject.

This brings me to the question of Resources. To us it seems obvious that the control and handling of engineer recources is an essential part of our engineering activity. On the other hand it is easy to build up a convincing case, from the point of view of those who are seeking a tidy administrative solution and who wish to eliminate functional overlaps between Corps, that this is a "supply business" which should be handled by a "Supply Corps". As a result of our representations the Army Board, when considering the McLeod Committee's recommendations, agreed that the resources organization should not be handled over, but that the Standing Committee on Army Organization should examine the problem in more detail and then put forward proposals. The question is still being considered. So far the Standing Committee have recommended that we should retain the Royal Engineer Resources Organization overseas, and a special working part is studying the set up in the United Kingdom. My hope is that we shall in the end be allowed to retain the whole of the Resources Organization, perhaps handing over a few fringe activities in the store holding or provisioning fields to the Royal Army Ordnanee Corps.

#### SUMMARY

On our current activities, I hope I have said enough to assure you that the Corps is still living up to its traditions all over the world, and that there is no lack of energy and enthusiasm for the work in hand. On the question of how we stand as a result of all the recent reorganizations, which I know is uppermost in your minds, I would sum up as follows:—

(a) The E-in-C, in common with other Arms Directors, will leave Whitehall. His office will move to Chatham in about October this year. He will be represented in the Army Department by a Brigadier under the Quarter Master General, a Colonel in Staff Duties, a Colonel in Army Equipment and a Colonel (as at present) in AG 7.

(b) Transportation and Movement Control will combine with the Transport element of the Royal Army Service Corps to form the Royal Corps of Transport. It is planned that the transfer of functions will start on 1 January 1965. A working party has been established to work out all details, including the many personnel problems which still arise as a result of the formation of the new Corps.

(c) It has been recommended that the Royal Engineer Resources Organization should be transferred to the Royal Army Ordnance Corps, but we have resisted this strongly and the question is still under consideration.

(d) There will be some changes in responsibility for repair of vchicles and equipment between ourselves and the Royal Electrical and Mechanical Engineers.

All the above represent losses in one form or another. On the credit side, we are making some progress, with the help of the Ministry of Public Buildings and Works, towards re-casting ESSE in a more useful form. We propose incidentally to bring back the title "Military Engineer Services (MES)" to replace ESSE. We are also discussing the possibility of taking over responsibility for operational airfield construction and maintenance from the Airfield Construction Branch of the Royal Air Force. This I regard as an important step towards recognition as the operational civil engineers for all three Services. In these ways I hope that our professional status as engineers will be improved, and a proper balance restored between combat engineering and civil engineering in the Corps.

We shall then be able to face the future with confidence.

#### TRANSPORTATION AND MOVEMENT CONTROL

In conclusion I must say a few words about Transportation and Movement Control, as this is the last time their activities will be considered at this Meeting. Our first feeling must be one of sadness that the Corps are to lose their long-standing association with railways, ports and movements, not only in the Regular Army, but also in the Army Emergency Reserve and Territorial Army where we have had such a close and happy association with the civilian railway and port authorities over the years. However, if change has to come, it must be accepted that the concept of a Corps of Transport, to handle all transport agencies and the movement service, is obviously sound and we can be sure that the new Corps will offer an interesting range of employment and reasonable career prospects to all who transfer to it. Here I would stress that this is in every sense an amalgamation, and not a take-over of Transportation by the Royal Army Service Corps.

In this my final report on the Transportation Service I would pay a general tribute to the great work they have been doing all over the world since the last war, often under considerable difficulties. Their keenness and enthusiasm has, on many occasions, been favourably reported on, and their standard of trade skill and seamanship is very high indeed. I will mention two of their achievements, which may be regarded as typical. Firstly, in Borneo where the operations depend for their support largely on water communications. The detachments of 17 Port Regiment operating there have done a tremendous job, using craft of all kinds from RPL's to long hoats, in support of actual operations, quite apart from their normal duty of handling stores in the ports of Kuching, Brunei and Labuan. In Aden, the Middle East Port Squadron has to provide lighterage facilities at the South Arabian staging ports at Salalah, Riyan and Masirah, operating in open anchorages in great heat often in difficult weather conditions. They make long sea passages in Z Craft and RPL's, commanded by sergeants and corporals, and have successfully faced weather conditions which would daunt many an ocean racer. I was delighted to receive a most handsome tribute from a sea captain of the British India Steam Navigation Company about their work during the last year.

As we say goodbye to these stalwarts of the Transportation Service in the New Year, I would remind you that this is not the first time that the Corps has brought some activity to perfection, and then set it up on its own feet. In this case we and the Royal Army Service Corps are founding the Royal Corps of Transport by a joint effort, and I feel we should all wish the new Corps the best of good fortune in the future.

## Presentation of the Institution of Royal Engineers Gold Medals and the Society of American Military Engineers Toulmin Medal

IN 1962 the Council of the Institution decided to found a Gold Medal to be awarded from time to time at their discretion as a mark of rare honour for some major work connected with the advancement of historical, scientific, or technical knowledge related to the activities of the Corps of Royal Engineers.

To commemorate the Queen's bestowal of the Royal title on the School of Military Engineering on 20 July 1962, the Council decided to award three gold medals. A Selection Committee consisting of the Chief Royal Engineer, the President of the Institution of Royal Engineers, the Immediate Past President, the Engineer-in-Chief, and Sir Lawrence Bragg, a distinguished Honorary Member of the Institution, was set up in 1963 to consider possible awards and, as a result of the Committee's recommendations, the Council agreed that gold medals should be awarded to:—

Major-General C. H. Foulkes, CB, CMG, DSO, Colonel Commandant RE (retired), for his pioneer work in developing chemical warfare during the First World War.

Brigadier H. Hotine, CMG, CBE, for his outstanding contribution to the art of military survey and especially for his work in the development of methods of mapping from air-photographs.

Lieut-Colonel E. W. C. Sandes, DSO, OBE, MC, the eminent historian of the Corps of Royal Engineers and the Engineer Corps of India and Pakistan.

The Chief Royal Engineer, General Sir Frank Simpson, GCB, KCB, DSO, DL, presented the medals at the Annual General Meeting of the Institution, held at the London Headquarters of the Royal Commonwealth Society on 24 June 1964. Major-General C. H. Foulkes and Lieut-Colonel E. W. C. Sandes received their medals in person. Brigadier Hotine's medal was accepted on his behalf by Brigadier L. J. Harris.

There was insufficient time for the Chief Royal Engineer to read the citation for each medal at the presentation ceremony. They are published below in full:---

Major-General C. H. Foulkes, CB, CMG, DSO Colonel Commandant Royal Engineers (retired) French Croix de Guerre, Belgian Commander Ordre de la Couronne and Croix de Guerre, American Distinguished Service Medal.

Major-General Foulkes was born on 1 February 1875 and educated at Bedford School and the Royal Military Academy, Woolwich. He was commissioned into the Corps of Royal Engineers on 27 February 1894.

Outstanding amongst his contributions to scientific knowledge has been



Photo 1. The Chief Royal Engineer presenting an Institution of Royal Engineers Gold Medal to Major-General C. H. Foulke

Presentation Of The Insitutuion of RE gold medals and the society of American Military EngineersToulmin Medal 1 his work connected with chemical warfare, at one time the responsibility of the Corps of Royal Engineers.

After completing his young officer training, Major-General Foulkes saw active service in Sierra Leone and in South Africa. He was also employed on an Anglo-French Boundary Commission in Nigeria and with the Ordnance Survey in Edinburgh, during his time there he became a Scottish international hockey player. In 1909 he went to Ceylon to command 31 Fortress Company RE returning in 1912 to command L (Depot) Company RE at Chatham.

During the early months of the First World War he commanded 11 Field Company RE on active service in France and Flanders.

On 25 April 1915 the Germans launched a surprise gas attack against French African troops in the Ypres salient, followed shortly afterwards by attacks against British and Canadian troops, and the British Government reluctantly gave permission to Sir John French, the British Commander-in-Chief, to retaliate in kind. Major C. H. Foulkes was appointed Gas Adviser to the Commander-in-Chief with the brief that a retaliatory attack had to be mounted as a preliminary to a joint Anglo-French offensive planned to start on 10 July 1915. An entirely new type of warfare had to be developed ab initio. After preliminary consultation with medical and scientific authorities it was decided to employ chlorine gas that could readily be stored in liquid form. Special storage cylinders had to be designed and methods devised to discharge a suitable form of gas cloud that could be used operationally. Four Royal Engineer companies were raised in France for the offensive use of gas, containing in their ranks many scientists, chemists, and University students. The Companies were incorporated into the Special Brigade RE which contained in addition a field chemical laboratory and a meteorological unit. Major Foulkes was promoted Brigadier-General and given command of the Special Brigade RE.

Owing to unfavourable weather the planned offensive was postponed and the first reprisal gas attack was launched on 25 September 1915 in the Loos sector. Five thousand five hundred cylinders containing 150 tons of chlorine were discharged from 400 emplacements established in the forward trenches on a 24 mile front, together with 46,000 phosphorous smoke candles and bombs. Simulated gas attacks, using smoke, were mounted in other areas. The attack was a complete success. Subsequently phosgene was used for cloud attacks and methods developed for the employment of gas shells, fired from guns and mortars, which made the use of gas independent of the prevailing wind. Electrically operated projectors (the Livens projectors) were also developed. Up to 400 of these could be fired simultaneously and 1,500 were used during the attack on Messines Ridge in 1917. Later in that year Brigadier-General Foulkes was made Director of Gas Services, British Armies in France and the following year he was, in addition, President of the Chemical Warfare Committee which covered both the offensive and defensive aspect of gas warfare.

After the war he served with distinction in India and in the United Kingdom becoming Chief Engineer at Aldershot. He retired in August 1930.

In 1934 he published his book Gas. A Story of the Special Brigade, RE, and in 1938 he wrote Commonsense and ARP. He also wrote papers on chemical warfare which have been published in both British and American military journals. Brigadier M. Hotine, CMG, CBE, Order of the Legion of Merit (USA)

Martin Hotine was born on 17 June 1898 and educated at Southend High School and at the Royal Military Academy, Woolwich. He was commissioned into the Corps of Royal Engineers on 6 June 1917, the top of his Batch.

Outstanding among his contributions to the advancement of the science of survey have been his development of the theory and practice of air surveying, particularly for military purposes, and the development of geodetic science and practical geodesy in the Ordnance Survey.

Brigadier Hotine saw active service as a young officer in the First World War. After the war he attended a series of courses at Chatham and he went as an undergraduate to Magdalene College, Cambridge.

From 1925-9 he served as a Research Officer on a War Office Air Survey Committee and from 1929-31 he was employed as a Staff Officer in the Geographical Section of the General Staff of the War Office. From 1931-3 he was in charge of the work on the Arc of the 30th Meridian in East Africa and from 1933 until the outbreak of the Second World War he was employed with the Ordnance Survey on the retriangulation of Great Britain. He went to France with the British Expeditionary Force in September 1939 as Deputy Director of Survey and after the withdrawal from Dunkirk he became Director of Survey, Home Forces. After a short period as Director of Survey in East Africa he became, in 1941, Director of Military Survey and Chief of the Geographical Section, the War Office and he remained in that important appointment until the end of the war. In 1946 he became Director of Overseas Geodetic and Topographical Surveys and Survey Adviser to the Colonial Office. Since his retirement in December 1963 he has been employed on research and development work with the US Coast and Geodetic Survey, Washington, DC.

In 1947 he was awarded the Founders' Medal of the Royal Geographical Society in recognition of his development of methods of mapping from air photographs, his geodetic work in East Africa, his work on the retriangulation of Great Britain, and for his outstanding work in meeting the heavy war-time demands of the Armed Forces for survey and maps.

In 1955 he was awarded the President's Medal of the British Photogrammetric Society in recognition of his very great services to the development of the theory and practice of air surveying.

When a Research Officer on the War Office Air Survey Committee, Brigadier Hotine was quite new to this subject and devoted his considerable mathematical ability, experimental aptitude, and tremendous energy to devising a practical workable method of using air photographs for topographical mapping, employing simple procedures and equipment, some devised by himself, based on sound principles. He was a pioneer of aerial triangulation for which his First Order expressions are still in use for work programmed for high-speed electronic computers. He also made considerable research into camera calibration and his results are still of value today. He recognized the pioneer work of Doctor H. G. Fourcade of South Africa and persuaded the War Office to develop the first Stereogoniometer, for which he devised a working procedure.

His primary aim in the early days was to develop working methods, but his contributions to the theory were exceedingly important and widely recognized



Photo 2. Brigadier L. J. Harris accepts a Gold Medal on behalf of Brigadier M. Hotine.

Presentation Of The Insitutuion of RE gold medals and the society of American Military EngineersToulmin Medal 2 in many countries. In the short space of six years he wrote four Professional Papers, each of book length, and also a text-book *Surveying from Air Photo*graphs—all of which were based on his own original work both theoretical and practical.

His practical methods developed over the years have been responsible for probably as large a coverage of good topographical mapping as has been achieved by any other single individual.

He was the moving force behind the retriangulation of Great Britain. This began in 1935 with a much reduced Ordnance Survey staff and insufficient money. He made up for these shortcomings by great technical ability and unbounded enthusiasm, and by 1939 the primary triangulation had been completed as far north as the Caledonian Canal. This was a remarkable achievement, for in five years there had been almost completed what had taken our forebears in the nineteenth century the best part of fifty. In the best traditions of his eminent predecessor (Clarke), he made full use of his mathematical powers to rationalize and bring up to date the methods used. Aided by his experiences in East Africa, he worked out the theory and practice of the methods to be followed. His *Theoretical Study of the Measurement of Bases by Invar Tapes* is now a classic and has resulted in fundamental changes in standardization and field procedure.

Since the last war, though engrossed in the setting up and expanding of the Directorate of Overseas Surveys, he found time to devote his powerful mind to developments in the science of geodesy and is a recognized world authority. He made a valuable study of the mathematics of projection systems and later turned his mind to the development of an entirely new and revolutionary system of computing and adjusting triangulation, based on observed directions in space rather than on directions projected on to a reference spheroid as had hitherto been the invariable practice. This work called for the exercise of mathematical skill of the most advanced order and, perhaps partly because of this, Brigadier Hotine's new system has yet to find universal acceptance amongst geodesists for terrestrial survey. But in the Space Age it cannot fail to be of great and increasing significance in the future.

#### Lieut-Colonel E. W. C. Sandes, DSO, OBE, MC, Croix de Guerre (with palms)

Edward Warren Caulfield Sandes was born on 13 February 1880 and educated at Monkton Combe School and the Royal Military Academy, Woolwich. He was commissioned into the Corps of Royal Engineers on 22 November 1899.

Outstanding amongst his contribution to the advancement of historical knowledge in relation to military engineering has been the books he has written on the works of the engineers of the British, Indian, and Pakistan Armies.

After completing his Young Officer training, Sandes was posted to India where he served continuously until October 1910 in Military Works Services. He was then appointed Professor of Civil Engineering at the Thomason Engineering College, Roorkee, remaining in that post until recalled for military duty in the First World War. In April 1915 he arrived in Mesopotamia in command of an Indian Sapper and Miner bridging train which was attached to the 6th Indian Division during the advance from Kut el Amara to Ctesiphon.



Photo 3. The Chief Royal Engineer presenting a Gold Medal to Lieut-Colonel E. W. C. Sandes.

Presentation Of The Insitutuion of RE gold medals and the society of American Military EngineersToulmin Medal 3 By the end of December 1915 he had bridged the River Tigris no less than seventeen times. The British and Indian force was, however, defeated at the battle of Ctesiphon and had to withdraw to Kut where it was besieged until forced to capitulate on 26 April 1916. Sandes spent the rest of the war as a prisoner in Turkish hands.

He rejoined the staff of Thomason Engineering College in February 1920, and in October the following year he became Principal of the College. He retired in August 1931.

Lieut-Colonel Sandes has written the following historical works:-

In Kut and Captivity, published in 1919.

Tales of Turkey, published in 1924.

The Military Engineer in India, Volume I, published in 1933, which dealt with achievements of the military engineers in India in war and in military works from 1640 to 1932.

The Military Engineer in India, Volume II, published in 1935, which recorded the outstanding services of military engineers while working as civil engineers, surveyors, scientists and administrators under the civil Government over the same span of history.

The Royal Engineers in Egypt and the Sudan, published in 1937, which described the services rendered by the Corps of Royal Engineers, both individually and collectively, in those two countries from 1800 to 1936. It tells the story of the advance across the Sinai of the Turkish Grand Vizier's Army in 1800, lead by Captain T. Lacey, RE, to attack the French in Cairo; Gordon in Central Africa; Graham fighting at Tel El Kebir and on the Red Sea Coast; Watson taking the Cairo Citadel almost single-handed; fleets of whalers toiling up the Nile; Gordon watching for relief that never came; Wilson leading a forlorn hope to rescue him; Kitchener pushing forward to Dongola; Girouard building the Desert Railway; Kitchener avenging Gordon's death at the battle of Omdurman. It also describes the outstanding work of RE irrigation engineers, railway engineers finding a path through the Red Sca hills; telegraph engineers floundering in the swamps of the Upper Nile; surveyors scaling the heights of the Abyssinian frontier; builders at work in Khartoum and Port Sudan, and RE officers employed as administrators caring for the welfare of the people.

The Indian Sappers and Miners, started in 1938 but, because of Lieut-Colonel Sandes' war work, not published until 1948, which described the achievements in peace and war of the Madras, Bengal and Bombay Sapper and Miner Corps from 1759 until the prelude to the Second World War, and of the Burma Sappers and Miners and the work of specialized Sapper and Miner Submarine Mining and Defence Electric Light units, Signal units and Railway units.

From Pyramid to Pagoda, being a history of the West Yorkshire Regiment in the Second World War, published in 1952.

The Indian Engineers 1939-1947, published in 1956, which described the exploits of the Indian Engineers in the Middle East, North Africa, Italy, Burma, Malaya, the East Indies and post-war India.

#### THE TOULMIN MEDAL

This Medal is awarded annually by the Society of American Military Engineers to the author of the article selected by a committee of judges as the best published during the year in the Society's Journal *The Military* 



Photo 4. The Chief Royal Engineer presenting the Toulmin Medal to Colonel R. L. Clutterbuck.

Presentation Of The Insitutuion of RE gold medals and the society of American Military EngineersToulmin Medal 4 Engineer. It was founded in 1932 by Colonel H. A. Toulmin, US Corps of Engineers, to encourage engineer officers to write.

The 1963 Toulmin Medal was awarded to Colonel R. L. Clutterbuck, OBE, recently chief of the British Section of the US Army Command and General Staff College at Fort Leavenworth, where he lectured on counterinsurgency and specially on the defeat of the Communist guerillas in Malaya. His prize-winning article, entitled "Military Engineering as a Weapon in the Cold War", was published in the July/August 1963 issue of *The Military* Engineer.

He is the first Royal Engineer Officer to be awarded the Medal.

The Medal was accepted by Colonel B. G. Rawlins on behalf of Colonel Clutterbuck at the 44th Annual General Meeting of the Society of American Military Engineers, held in the Mayfair Hotel, Washington, DC, on 25 May 1964. Colonel Rawlins sent the Medal by air and it arrived in time for the Chief Royal Engineer to present it formally to Colonel Clutterbuck, after the presentation of the Institution Gold Medals, and to congratulate him on his unique award.

Colonel Clutterbuck's prize-winning article is published in this edition of the Journal.

## Presentation of Airborne RE Silver Centrepiece

#### By Brigadier F. H. LOWMAN, DSO, MBE

At the annual dinner of the Airborne RE Dining Club, held at the Naval and Military Club in London on 11 April 1964, a silver centrepiece was presented to the Chief Royal Engineer for the Corps of Royal Engineers. With the approval of the RE Corps Committee the centrepiece is being made available on extended loan to the parachute RE units of the regular and reserve Armies-9 Independent Parachute Squadron RE and 131 Parachute Engineer Regiment (TA). As 9 Parachute Squadron RE has of necessity to lead a rather nomadic life, 131 Parachute Engineer Regiment (TA) has kindly consented to look after the piece and make it available as required.

The Airborne RE Dining Club was founded in 1946 as a 6 Airborne Division RE Officers' Dinner Club and later extended to include officers who served in 1 Airborne Division as well. Membership is restricted to officers who served in either division between the inception of Airborne Forces and V-J Day. The officers commanding 9 Parachute Squadron RE and 131 Parachute Engineer Regiment (TA) attend as honorary members. The Club has dined each year in London since 1946, thirty-five to forty strong, and the occasion goes by the name of the "Gin Palace".

Some three years ago the Club decided to raise funds by purely private subscription for a memorial centrepiece and there was a generous response both from Club members and officers of 9 Parachute Squadron RE and 131



Parachute Engineer Regiment (TA). Designs were invited to conform to a rather elusive specification, embodying both an engineering and an Airborne motif. From three designs submitted, one was selected, subject to some modifications. The design chosen was by A. Cannon, Esq., principal lecturer in metalwork at the Shoreditch Training College, Cooper's Hill,<sup>1</sup> who also executed the piece in hall-marked silver. The engraving was by Messrs T. and A. Wise Ltd.

The centrepiece, which stands some 24-in high, is in a fairly modern style and out of the ordinary by comparison with normal centrepieces. In fact this striking and unusual piece has already aroused high praise in craft design circles and a photograph has been published in the *Daily Telegraph*.

## Military Engineering as a Weapon in the Cold War

By COLONEL R. L. CLUTTERBUCK, OBE Royal Engineers, British Army

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Colonel Clutterbuck was awarded the Society of American Engineers' Toulmin Medal for this article. Details of the award are published elsewhere in this Journal.

In the present world-wide struggle to win the hearts and minds of people, spoken of as the cold war, insurgency is fast replacing formal warfare because success for the insurgent, when it comes, is spectacular and cheap. Guerrilla warfare is the poor man's war, needing no billion-dollar budgets, but only men and hand-held weapons. It is this very poverty which offers such scope to the army engineer, for he, with his rifle near at hand, can bring the people what they want more than anything else—a restoration of orderly life, security, and a real hope of increasing prosperity. And because they can see soldiers in uniform doing things which are patently to their benefit, their whole attitude towards soldiers can change from one of fear to one of friendship. And then the war is on the way to being won.

Insurgent warfare has flared up in twenty-six places over the world since World War II. Such action is usually communist inspired but not always. Sometimes, the common threat of communism keeps rival racial or political factions at peace, only for them to fly at each other's throats when the threat recedes. Even then, it is no less important to restore order, because such strife will usually result in tyranny or chaos, which in either case will drive the people to a degree of despair which welcomes the communists as liberators.

In only three of the twenty-six so-called small wars have the communists gained firm control in spite of the efforts of the allies—China, Cuba, and North Vietnam. In none of these cases have American or British soldiers been involved. Another six were "ties" or are still in the balance; for example, Korca and South Vietnam. But at least seventcen were victories. Of them some were major communist defeats, as in Greece, the Philippines, and Malaya; others were the prevention of domination of one race or group by another, or of a threatened invasion or rebellion, such as in Cyprus, Kenya, Lebanon, Kuwait, and Brunei. In every one of these places, peace has been restored and the threat of tyranny, chaos, or communism has been removed at least for the time being.

The task of the engineers in such operations is comprehensively described in a United States Army Engineer School text.<sup>1</sup> Cited here from the author's experience are examples, not so much concerned with the technical aspects, which were mainly very simple, as with the effect of the engineer tasks on the attitude of the people and the outcome of the operations. These examples are from two very different wars, the communist defeat in the dense jungle of Malaya, and the prevention of Yemeni incursion and subversion in the hot rocky mountains of Aden and the South Arab Federation.

<sup>1</sup> Special Text 5-170, Engineers in the Cold War.

At the two ends of the base are engraved the RE cap badge, with the King Gcorge VI cypher to relate it to World War II, and the parachute Wings. On one side is the presentation inscription which reads, "Presented by Airborne RE Officers who served in the 1939–45 War to commemorate the wartime deeds of their comrades". Implicit in this wording is a memorial to all Airborne Royal Engineers who gave their lives in the Second World War. On the other side of the base are listed the airborne assault operations in which the sappers of both 1 and 6 Airborne Divisions took part as follows:—

1941 S. Italy—Tragino Aqueduct
1942 France—Bruneval
1942 Norway—Gliders
1942 N. Africa
1943 Sicily
1944 Normandy
1944 S. France
1944 Arnhem
1945 The Rhine
1945 Greece

At the presentation dinner on 11 April 1964, the guests were General Sir Frank Simpson (Chief Royal Engineer), General Sir Richard Gale (first GOC 6 Airborne Division and later Commander 1 British Airborne Corps), Major-General Urquhart (GOC 1 Airborne Division), Major-General Bols (GOC 6 Airborne Division), and Major-General Duke (Engineer-in-Chief). Unfortunately Lieut-General Sir Frederick Browning, the founder of Airborne Forces and first GOC 1 Airborne Division, was prevented from attending. The Chair was taken by Brigadier Sir Mark Henniker, who was the original Airborne CRE.

The permission of the Worshipful Company of Goldsmiths to reproduce the illustration is gratefully acknowledged.

#### Note by Editor

The Royal Indian Engineering College, Cooper's Hill, Englefield Green, Surrey, was founded in 1871 to train young men for careers in the Indian Public Works, Telegraph, and Forestry Departments. General Sir George Chesney was largely responsible for the establishment of the College and became its first President. Other famous Sapper officers followed him as President and as instructors; others served on the Board of Visitors.

Although primarily designed to meet Indian needs, several graduates from the College were commissioned into the Royal Engineers and others served with distinction as civil engineers in Egypt.

The College closed down in 1903 due to the establishment of faculties of engineering at Cambridge and other Universities.

The past members of the Royal Indian Engineering College founded a Cooper's Hill War Memorial Prize in memory of their fellow members who fell in the First World War. The prize is awarded annually to the Institution of Civil Engineers, and in rotation to the Institution of Royal Engineers (for a paper on an engineering subject of military value), the Institution of Electrical Engineers and the Department of Forestry, Oxford University. The prize, consisting of a bronze medal, a parchment certificate and a sum of money (about £40), falls to our Institution next year.

The buildings originally occupied by the Royal Indian Engineering College are now in the possession of the Greater London Council and house a Training College for Teachers of Arts and Crafts, known as the Shoreditch Training College, Cooper's Hill.

#### MALAYA—THE JUNGLE FORTS

As the communist guerrillas lost ground in the jungles close to the heavily populated rubber and tin-mining areas of Malaya, they sought to set up new secure bases in which to re-train and re-form their shattered units. These bases were in remote mountainous jungle, three or four days' march from the populated areas. At first the communists tried to grow their own food by clearing patches of jungle, but their clearings were spotted by air reconnaissance, and were ambushed or destroyed. So the guerrillas sought increasingly to rely on the aborigine tribes for food. These tribes lived a primitive life along the river banks, catching fish and game with blowpipes, and growing dry rice and tapioca by a system known as "shifting cultivation". In this procedure they felled an area of jungle, and burned the dead trees and undergrowth to make ash to fertilize the soil. From this they grew one crop. Then they moved on, burning their bamboo long houses behind them, to fell a fresh area of jungle farther along the river. Behind them the jungle grew up again in the dense tangle known as secondary jungle, in which progress is measured in hours per mile, and a man can pass another without seeing him at 5 yards' range. The Chinese communist guerrillas set about making friends with these nomadic tribes, and helped them to grow more food in exchange for a share of it for themselves.

The aborigines knew nothing of politics. "Government," if it meant anything to them, usually represented a seemingly interfering official who may have driven them out of some forest reserve or water catchment area. Attempts by the government to resettle them in villages closer to civilization failed. They pined for their nomadic life, and, when out at work, would vanish and head out again for the deep jungle.

The only possibility of holding these people lay in extending the services of government to their own ground, in such a form that they would be attracted away from the guerrillas by something the guerrillas could not give them: such things as trade, education, and, above all, medical care. Doctors or army medics here are welcomed as saviours wherever they go.

The first stage was to find out where the nomads lived and establish friendly contact with them. This task was given to the Special Air Services (SAS) Regiment (the nearest equivalent to the United States Special Forces). Guided initially by air reconnaissance of the aborigine clearings, SAS troop units, each about fifteen strong, landed by helicopter and lived in the jungle, based on air supply, each for 13 weeks before relief by a fresh unit. Accompanied by members of the Government Aborigine Department, they offered at once the beginnings of an outlet for trade through their helicopter and airdrop contacts. Fish, food, and bamboo poles were paid for with tools and cloth from the towns. The troop medical men were soon surrounded by a large daily "sick-call", and when needed, a doctor could be brought in by helicopter within hours. The people began to realize that these soldiers could and would do far more for them than the guerrillas, who had now scuttled away to pester some neighbouring tribe.

The SAS had many engineers in their ranks, and all had some basic engineer training. Joined by officers from Royal Engineer units, they selected a site in the tribal area where a STOL<sup>1</sup> airstrip could be built, and eventually, if possible, a jungle track to civilization. The jungle fort was a semi-permanent

<sup>1</sup> Short take-off and landing.

infantry or police company base, with huts built from local timber and palm leaves, all-weather storage for supplies, a water supply, and a helicopter pad.

Next, ten or twenty engineers would arrive, with power tools, explosives, and sometimes a light dozer (shipped in parts), and in a few months would open a 300-yard airstrip. The subsoil under a light humus layer was sandy with a good deal of laterite, which binds and compacts well to make an allweather surface. Little material had to be flown in for these forts.

The trading, schooling, and medical services of the fort were vastly increased once the airstrip was opened. The tribes found it advantageous to live nearby. So when they made a clearing for their next crop, they picked an area near the fort. Guerrillas were no longer welcome, and their appearance was quickly reported to the garrison. Young aborigines were recruited as trackers and guides, and later trained to form their own patrols. For the first time they earned pay, and their schooling and health were improved. The guerrillas moved elsewhere, to hunt with growing despair for some door that would not be closed to them.

Today, there is no guerrilla threat in this area except on the Thai border. The company garrisons of the forts have shrunk to small police posts. But the schools, the health clinics, and the trading shops still operate, and the inhabitants still centre around them, living the life that suits them, but with benefits that they never had before.

#### THE KEDAH ROADS

By 1957, the communists were losing ground all over Malaya—except as noted along the Thai frontier, where Chin Peng, the communist secretary general, and his Central Committee, with 400 diehards, had gone to direct what was left of their campaign, and to hold out in the hope of better times. This hope did not seem to them to be in vain. Mao Tse-Tung had held out for eleven years in North China against tremendous odds, but in time his chance came and by 1949 he ruled China. Chin Peng, no doubt, had similar hopes, but such hopes depend on retaining a hold on the people in the villages, which can later be used as bases from which to extend control.

Kedah, the northern border state of Malaya, is a rich rice-growing region. Food control, so effective elsewhere in Malaya, was virtually impossible there. If the guerrillas could live in the jungle fringes within range of the padiworkers' villages, the foundations for their revival would be strong. This fringe area was different from the rest of Malaya. The roads and tracks branched and ended like fingers as they approached the wild mountainous jungle ridge that was the frontier. But many of the valleys in the foothills which were suitable for cultivation were settled by a half-caste Malay-Thai breed called Sum-Sums. They were not as primitive as the aborigines, or as nomadic. They cultivated wet padi in small, isolated fields in the steep river valleys. With no settlements within many miles, the only way these people could reach a market or a doctor was on foot along 15 or 20 miles of jungle trail. So they had little contact with the outside world and grew only the food they needed.

The communist guerrillas were friendly to them. They helped the Sum-Sums with their cultivation, and paid them for surplus rice, usually at more than market price. So the arrangement suited both sides, and the guerrillas were able to live in comfort within easy range of their real target for subMILITARY ENGINEERING AS A WEAPON IN THE COLD WAR 257



Photo 1. Malayan Aborigines with blowpipes



Photo 2. Jungle fort with airstrip

Military engineering as a weapon in the cold war 1 & 2.



Photo 3. Typical jungle fort



Photo 4. A new village developed under the resettlement plan in Malaya

Military engineering as a weapon in the cold war 3 & 4

version-the Chinese padi growers around the fingers of road in the rich plains of Kedah.

Once again, the answer was for the government to provide the Sum-Sums with more of the things they wanted than the communists could give them security, education, medical care, and a market for their surplus crop.

The solution in this case was a 64-mile roadway or loop bowed out from the fingers of the existing road. Malaya was by this time independent. The road was built by British, Malayan, and Gurkha Army Engineers with British-operated plant. The operation was directed by the Royal Engineer officer employed by the Malayan Government as Chief Engineer of the Federation Army. The British and Gurkha troops and plant were of course provided free. The materials and local labour were provided by the Malayan Public Works Department. The Army Chief Engineer was provided with a bank account from which he could spend as he pleased. In practice, the spending was decentralized down to detachment commanders.

Materials presented no particular problems, but the method of recruiting labour was unusual. For example, the little village of Naka, at the end of one of the roads, had a population of 1,200 and everyone worked in the fields. The engineer commander gave the village headman a fixed sum to provide 100 men for 8 hours a day. The men varied from day to day and even from hour to hour, but the headman did his part and saw to it that there were always 100 heads to be counted bobbing about in the drainage ditches and clearings along the road.

The villagers revelled in the job. They earned money. Work on the road made a welcome break from their toil in the fields. Moreover, they knew that the road would increase the trade of Naka market. Never were so many smiling faces seen in Naka, and especially for the army engineers. The same smiles greeted them all along as they opened up the pilot track through the remote settlements.

It took two years to complete the road through the very heavy jungle. Some of the trees were 18 or 20 feet in circumference. There was a culvert about every mile (it rains every day in Malaya). There were also many bridges, including a multispan pre-stressed reinforced concrete bridge designed to withstand seasonal spates with a forecast flood level up to 9 feet above the roadway.

One combat engineer squadron (average working strength 100 to 150) was usually employed at a time, almost entirely on the concrete bridges and culverts. The road between was made by a few pieces of engineer plant with local labour. The two-lane surface was compacted laterite. Some day, the Public Works Department will add a black top, but that would have been a needless luxury in 1958.

The effect has been exactly as was hoped. These remote people now have a stake in the government, which has provided improvements without destroying their traditional way of life. Doctors and teachers work among them, and a regular truck collects their produce for cash. Police posts and patrols keep them free from molestation by the Chinese guerrillas. But the guerrillas themselves keep away, for they know that the Sum-Sums will report them if they do appear. So they have been driven back to the deep jungle frontier, three or four days' march from the only people on whom they could ever hope to base a revival—the Chinese villagers in the plains. They have now lost all contact with these villagers, and the villagers certainly do not want them back.



Photo 5. Chinese rubber-tappers' village

#### CIVIC ACTION

In the Chinese villages, the first aim was to encourage the people to say what they wanted, and then to help them to get these things as soon as possible, in the order of priority they preferred, by providing materials and assistance from government or army engineers. With this approach, the people were eager to provide labour, and there was, of course, goodwill between the people and the engineers.

Meanwhile, the bigger projects to develop the overall economy of the nation were also pressed ahead. The projects were explained to the village leaders, both in the capital and on the sites of the projects. They returned to their homes with a clear idea of how these projects would eventually increase the prosperity of their people. This they explained to the villagers, but the explanation would have had a bitter taste unless the people could already see the urgent simple things they needed—such as water supply, electric power, drainage, and roads—being provided before their eyes.

It was found that immediate comfort and security, the visible promise of better things, and the hope of a rising standard of prosperity in the future were all important, but in that order.

#### Military engineering as a weapon in the cold war 5

#### Aden and the South Arab Federation

The British Colony of Aden consists of a pair of extinct volcanos jutting out from the south-western corner of the Arabian peninsula. On one is an oil refinery. Between them lies a sheltered harbour which has for many years been a refueling port for ships heading to and from the Far East. Inland, a 50-mile belt of desert leads to a 7,000-foot range of rocky mountains. They rise from the plains in a sheer 4,000-foot escarpment, on top of which is a relatively fertile area of highlands comprising the most important part of the territory of the eleven Arab Emirs, Sheikhs, Sultans, and Sherifs who form the South Arab Federation. These fertile highlands have long been coveted by the Yemen. The eleven rulers, therefore, have a treaty under which Britain helps in their defence with forces based in Aden Colony, and assists in the training and organization of their army.

In the highlands, the frontier is not easily identified among the sharp rocky peaks. Every tribesman carries a rifle (of varying vintage) and if he sees another grazing a flock on his land or cutting his crop, he sends a bullet echoing between the hills, usually at a polite range of about 600 yards. The courtesy is returned, and, after a sporadic exchange the intruder usually withdraws.

In 1958, there was an increasing tendency for formed bodies of Yemeni troops, sometimes several hundred strong, to use such interchanges as an excuse for crossing the frontier to "restore order". The troops of the Arab Federation would react and, if necessary, call by radio for support by the Royal Air Force from Aden. Before long, rockets would be crashing into the hillsides, and the two bewildered tribesmen would be wondering what they had started.

Meanwhile, using techniques from an obvious source, attempts were made to subvert the tribesmen. Rebel leaders began to appear, trying to build up an image of government as an organization which did nothing but impose restrictions and demand taxes—and was therefore to be kept out. Most of the tribesmen had a deep-rooted loyalty to their tribal leader, but in some areas the rebels overcame this, and the Federation troops (and their British allies) were treated with some hostility.

Only at the extreme western end of the highlands was there a road up the escarpment—a rough rocky track built by a previous generation of military engineers in World War I. It could carry 3-ton trucks, provided that they took care not to meet on the pass up the escarpment. Otherwise, the only access to Aden was by air, or by a long journey up one of the few precipitous paths by camel or donkey or on foot. Above all, the "exports" from the fertile highlands to the market in Aden either had to go by air or very slowly by land, at great cost either in money or time.

In 1959, an independent troop of British Royal Engineers was sent to develop mountain tracks in the area. Their first task was to open a lateral route along the most fertile part of the highlands, to enable artillery and armoured cars to move quickly against raids. The track was cut by a detachment of twenty engineers, using compressor tools brought in by air. The reaction of the tribesmen was initially unfriendly, and in the fall of 1959 the engineers were ambushed with the loss of one killed and one wounded.

The task was completed by the end of the year, and the unit was relieved in 1960 by fresh troops that set about linking this frontier track with a spectacular and ambitious new pass being built up the spurs of an almost sheer

R.E.J.-K



Aden and Hinterland

4,000-foot escarpment by the Public Works Department of the Federation. As this progressed, the attitude of the tribesmen began to change. They realized that these soldiers had not come to oppress them (as rebel propaganda claimed) but were clearly doing something that would make a big improvement to their sales of livestock and crops to the markets in Aden and the plains. By late 1960, the twelve engineers who were engaged on the track were greeted everywhere with smiles and gifts of eggs and fruit. They were accompanied by six members of the Sultan's personal bodyguard. These guards would have proved tough fighters if the detachment had been ambushed again, but their real value lay deeper than that, for their presence signified to everyone that the Sultan was personally supporting this venture, and to most tribesmen this was all they needed to know. A shot at the Sultan's guard was a personal shot at the Sultan, with obvious consequences. With this uncompromising lead from the top, the tribesmen were courteous and friendly, which was part of their nature, and there were no more ambushes.

By the end of 1960, this part of the highlands was linked to Aden by a road designed for jeeps, but which is now taking 3-ton trucks at alarming speed every day. And to the people served by this road, the soldiers are friends.

In 1961, the engineers accompanied a column of Arab infantry into an area which no government authority had been able to penetrate for some years. Blasting their way up precipitous re-entrants and rock faces, they built a road which had the immediate effect of opening the country to motorized troops


Photo 6. A section of the road along the edge of the escarpment in the South Arab Federation.

and guns, but its real significance was for trade. This fact was not lost on the tribesmen, who knew that the rebel leader could not give them roads or the benefits that roads can bring. The roads are rough, but the rebel leaders have gone and are unlikely to return. If they do they will not be welcome and the reaction of the Arab Army will be swift.

This project was followed in the autumn of 1961 by an even more ambitious road along the fringe of the escarpment linking all the systems at the eastern end with each other. It is 25 miles long and was built by twenty engineers with Arab infantry and tribesmen in three months.

The junior Royal Engineer officers who built these roads had some of the most independent assignments in the army. They, and their NCO's, have learned the true meaning of cold-war soldiering. And their personal development under responsibility was a real investment in their future.

#### CONCLUSION

The cold war will be won or lost in the emerging nations. Their future will remain in dispute until their prosperity, and the promise of increasing prosperity, is assured in the eyes of their villagers and tribesmen. To them, this matters far more than the political complexion of the government which provides it.

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By kind permission of The Associated Press Ltd.

Photo 7. LUDGATE HILL IN SOUTHERN ARABIA. Some 300 British Sappers of the Royal Engineers and 450 Arab labourers are now building a 17-mile circuit road through the Rabwa pass in the Radfan mountains of Southern Arabia, to ease the supply problem to forward military units fighting rebel tribesmen. Sections of the road have been given London street names and this alpine section is known as "Ludgate Hill". During the operation the sappers are blasting away thousands of tons of rock and when completed the road will also open up the district to commercial road traffic, in the past local tribes have had to rely on camels or mules to communicate with the outside world.

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The West can do far more than the communists in helping to provide this prosperity, and it must capitalize this power. Although the big projects may in the end count the most, they are of little use unless the people are first won firmly onto the side of the lawful government. In only one of the examples quoted in this article were there more than twenty army engineers on the ground. Yet in each case they totally transformed the political and security situation by bringing the people onto their side. It is the small projects which the villagers can see as improvements of their lot that really count in winning the hearts and minds of the people.

Army engineers are ideal for tackling such tasks in remote places where men have to carry guns. And the sight of soldiers in uniform doing such work in an emerging country presents an image of the soldier which makes enemy propaganda look ridiculous. For the engineers themselves, and particularly for the junior leaders, there is no finer experience, and no better way of breeding the generals for the next round of the cold war.

The West should not be content only to send advisers and supervisors; it should send as many engineer troop units on these assignments as the most boldly calculated risk will allow.

Note. Photos 1, 2, and 5 are by the Photo Information Services Federation of Malaya. All others, except Photo 7 with this article are by the British Central Office Information.

## POSTSCRIPT JULY 1964

A year after I wrote this article I again visited Southern Arabia. Our detachment of seventy-four men had meanwhile built up to almost the whole Regiment, and is still increasing. They continue to operate mainly in troop or smaller detachments. Amongst their many tasks, they have widened and improved the pass up the 4,000 ft escarpment from Lodar to Mukeiras, and several hundred tons of freight go up and down it every day. Even more significantly, the crops on the plateau are getting greener, with over 300 deep well pumps in operation, brought in and maintained by the road—a big advance on the bucket and rope. There is very little shooting to be heard around Mukeiras these days.

The heat of the war is now focussed on the western end of the escarpment, where the new republican regime in the Yemen has trained, paid, and equipped a force of dissident tribesmen in the Radfan mountains to mine and ambush the Aden-Dhala road. In January 1964, a troop of sappers went into these mountains under the cover of a battalion operation by the Federal Army, and in three weeks blasted a jeep track up the Wadi Rabwa. After some hard fighting, the enemy damaged and closed this track in April, but at the time of writing it has just been reopened by fresh sappers flown in from Kenya and the UK. As *The Times* commented in the caption of a photograph on 17 June 1964 "The road is being built to case the supply problems for forward military units and it will also open up the district to commercial road traffic".

It is on this final point that our operations continue to be based. As in Malaya in 1958 and Mukeiras in 1960, so in the Radfan in 1964. In the ebb and flow of battle, a tribesman may be temporarily swayed by force of arms and propaganda, but in his heart and his mind he is more deeply impressed by the sight of laden trucks at harvest time and the sound of deep well pumps pouring water onto his land. We can give him these things, and we must. The dividend may take time to pay, but it is no fluke that Malaya is the most stable country in South East Asia, and the Mukeiras plateau the most peaceful part of Southern Arabia.



Dedication Service at St Martin's Garrison Church, Longmoor Camp

# Dedication Service at St Martin's Garrison Church, Longmoor Camp

# By MAJOR R. E. WILLIAMS, RE

ON 25 April 1964, a service was held at St Martin's Garrison Church, Longmoor Camp, to dedicate renovations and gifts.

For three months' work had been in progress on refurbishing the church, during which time a honeycomb ceiling and screen work designed by A. L. Lansdell, Esq, had been built in the chancel. New lights had been installed throughout, and those in the nave were fitted to wooden replicas of locomotive driving wheels made in the Railway Workshops. The Church was redecorated cream and pale blue and the parquet floor was sanded and polished.

The gifts included a pew presented by Lieut-Colonel D. C. Merry, Commanding Officer of 16 Railway Regiment RE from 1956 to 1958, a pair of silver altar candlesticks, a new altar cloth, and a priest's prayer book.

The service was conducted by The Rev M. C. Lillingston-Price, Garrison Chaplain, with the Senior Chaplain to the Forces, Aldershot District, The Rev N. S. Metcalfe, in attendance. The Chaplain General to the Forces, The Venerable Archdeacon I. D. Neill, CB, OBE, performed the Dedication and gave the Address. Amongst the congregation of about four hundred people were the Engineer-in-Chief, Major-General G. W. Duke, CB, CBE, DSO, past and present commandants and commanding officers at Longmoor; retired senior officers from RE Transportation, COs of units near by and other local dignitaries.

After the service the Engineer-in-Chief took the salute at a march past of 16 Railway Regiment RE and the REA. This was followed by a lunch for the guests and Longmoor officers and their families in the Officers' Mess. The Chaplain General, and the Engineer-in-Chief were also entertained in the Warrant Officers' and Sergeants' Mess.

This dedication service marked another stage in the improvements to the Garrison Church of Longmoor, which started from humble origins and is now one of the finest in the country. In 1931 permission was granted to convert what was then a forage barn into a church, and the bare necessities of a harmonium, choir stalls and a pulpit were provided. In 1936 a beautiful Reredos was dedicated to the memory of Railway Troops RE who died in the Great War, and this was shortly followed by gifts of stained glass windows from the Railway Companies of Great Britain, and a font.

After the 1939-45 War more stained glass windows were added to commemorate those who had fallen. The first of these was presented by the Canadian National and Canadian Pacific Railways, and others were given by the Port of London Authority and various inland water transport, dock and railway organizations. Twenty-three pews were also given during this period by units and individuals, to replace the hard-backed wooden chairs.

This church has a warm place in the hearts of many who have served with RE Transportation and Movement Control Services. Not only is it a pleasing place in which to worship, but it brings into focus the close ties between the Corps and the civil railways, ports and inland water organizations in Great Britain and in the Commonwealth. These ties have been strong in two world wars and in the years of peace between; may they continue and strengthen in the Royal Corps of Transport.

# By LIEUT-COLONEL A. G. TOWNSEND-ROSE

THE Royal Military College of Science, at which there are at present more Sappers than any other Arm, celebrates its Centenary this year. Big changes are being planned in the training of staff officers to begin in 1966. In spite of our strength in the College, many in the Corps know little about the College and its functions, and it therefore seems appropriate to write this article.

In 1772, two young gunners, Williams and Jardine, founded for the study of gunnery the Military Society of Woolwich which was later swept away by war. However, in 1840 the RA Institution was formed supported by voluntary contributions, but a Director of Artillery Studies was not appointed until 1850. The advanced class for artillery officers began in 1864, being a two-years course in mathematics, hydrostatics, physics, chemistry, and metallurgy. This course is the origin of the College. Opened to all arms in 1885 the class was transferred to the new Artillery College also in Woolwich. It was renamed the Military College of Science in 1927 by which time the scope had extended far beyond gunnery. During the Second World War the various divisions were dispersed to Lydd, Stoke-on-Trent, Bury in Lancashire, and Rhyl. In 1946 the Guy Committee on Technical Organization and Training in the Army recommended an increased technical staff and also the formation of an Imperial Military College where young officers could take degrees. Although the full concept of this College was not accepted, many of the recommendations of the Guy Committee were agreed, and as a result the College was reassembled at Shrivenham on an expanded basis, including provision for the graduate education of young officers in Science and Engineering. The title "Royal" was granted in 1953 as the result of the efforts of Major-General B. C. Davey, CB, CBE, the "Sapper" Commandant at that time.

The College stands in the 750 acres of Beckett Estate, mentioned in the Domesday Book in 1086 as the Manor of Becote. It was held at that time by William, Count of Evreux, a Norman whose tenure was granted directly from the King. King John was actually in residence in 1202. The present house built in 1834 replaced one burnt down, but there are relies of an ancient mill at the outfall of a most beautiful lake, and many of the fine trees date from early times. The downs which lie to the south of the estate carry the ancient Ridge Way of England, along which is a chain of ancient village sites and long-barrows of the Dobunnii. Their famous White Horse is carved in the chalk down facing the College and dates from about AD 100.

Four great barrack blocks and the attendant squares and garages were completed in 1939 and were used by the Royal Artillery until 1942, when the US Army took possession. In 1946 barrack rooms and kitchens were converted into lecture rooms and laboratories for the College, two blocks being used to house officers and staff, and the other two and the out-buildings for the teaching faculties. Continuous development has not overlooked the provision of a very large number of officers' quarters in the surrounding acres.

The Charter of the College states that it will be a centre of study with the

role of educating officers in pure science and technology, so that they may be capable of appreciating the scientific and the engineering problems in relation to the technical aspect of war. It will also train officers to apply their military knowledge and experience to advise those responsible for the design and development of material, regarding practical military limitations and requirements. It will study the inter-relation of tactics and armament technology and those means of scientifically assessing the influence of the one upon the other. In short, at Shrivenham the Science of War is to be studied, at Camberley the Art. The College carries out the first of these functions by running London University external degree courses. The second is achieved by the two and a quarter year technical staff courses which graduate officers join for the last eighteen months only. The College also trains selected regimental officers in fundamental and applied science in a number of specialist subjects. In addition, the College has maintained its esteem in the academic engineering and military worlds by its research and liaison in a great variety of subjects and by its development of teaching aids.

The College is organized into seven departments each headed by a Professor. They are: Mathematics and Ballistics, Physics, Chemistry and Metallurgy, Civil, Mechanical, and Electrical Engineering, and Instrument Technology. These have the dual responsibilities of teaching degree and technical staff syllabi. Integrated into these departments are local lieutenant colonels to apply the instruction to current weapons and Army policy. This Military Directing Staff is organized into three divisions, Weapons and Vehicles, Electronics and Guided Weapons, and a General Division. The latter is responsible for Nuclear Chemical and Bacteriological Warfare, and the general staff training of technical staff students; and organizes the course run for all Staff College students from October to December. The scientific and engineering equipment for student experiment and research is truly magnificent and surprises all visitors. In addition to the normal university engineering laboratory facilities there are among many others nuclear, aerodynamic, guided weapon, telecommunication, radar, and fuels laboratories. The standard of instrumentation in these laboratories is high. Of the twentytwo military directing staff, five are at present Sappers and two retired Sappers teach on the academic staff. One of the four halls of residence is commanded by a Sapper and we have just bidden farewell to a Sapper Commandant, the fourth in the last thirteen years.

In the eight years prior to 1958, 295 Sappers attended degree courses of whom eleven obtained first class and seventy-one second class honours. Ninety-three obtained pass degrees. In the following five years on average, seventeen Sapper officers a year have obtained three second class and six pass degrees. Most of the failures occurred at the end of the first year. The Sapper standard has on the whole been above that of the other Arms at the College, and the overall College standard has been above that of the other London University external degree candidates. Because of their overlong continuous academic training, young Sapper officers will in future join a regiment after leaving Sandhurst and completing some YO training at the RSME. They will then begin their degree course refreshed and with some experience of soldiering behind them. As a result there will be no Sappers on the nineteenth degree course beginning in October 1964. Perhaps the Sappers on twentieth degree course will get their hair cut more often! Sappers generally read for the civil engineering degree, although a few take mechanical engineering, normally



Photo 1. Beckett Hall Mess with instructional and laboratory blocks on right and accommodation blocks and married quarters in distance.



Photo 2. TSOs studying Centurian's gun control equipment.



Photo 3. Degree students at their laboratory work.



Her Majesty, the Queen Mother talking with Colonel and Mrs O. C. S. Dobbie; in the foreground are Lieut R. O. M. Dobbie, RE, a degree student, and Lieut W. I. C. Dobbie, RE, BSc, who had earlier been presented with his degree by the Queen Mother. Major-General E. J. H. Bates, OBE, MC, MA, is on her left.

read by REME officers. The Corps lays down a range of subjects which officers may study.

About ten engineer technical staff officers are trained each year. Because of the wide field encompassed by modern weapon systems and the depth of knowledge required by the present technical staff officer, students specialise in vehicles, weapons, or instrument technology. The latter includes all the electronic sciences. Sappers normally gravitate towards the vehicle field, which they find easiest after their mechanical sciences degree, but a growing number are learning to cope with electronics, which must play a big role in future war. In addition to their technical training they attend an eleven week course on staff studies based on a Camberley syllabus. The functions of a technical staff officer were enumerated in 1944 in the Guy Report, and it is generally agreed that these still hold today. The main points are:—

(a) To assist the general staff in formulating weapon requirements.

(b) To guide the policy of the staff engaged in design and research establishments and to contribute trained military knowledge to their problems.

(c) To interpret service requirements to the civilian and the civilian's problems to the soldier.

(d) To ensure that designs produced are in all respects suitable to meet military requirements.

Sappers with technical staff training are filling a great many vacancies, not only in the Research and Development Establishments and the Master General of Ordnance branch of the Army Department, but in combat development, intelligence at home and overseas, equipment policy, Ministry of Aviation and other branches and establishments. Some of these appointments such as in the Directorate of Royal Engineer Equipment are Sapper posts, but a great number are normal technical staff posts. The graduate of the technical staff course has a very high chance of a second grade staff appointment in marked contrast to his brother officer from Camberley.

Every Staff College student attends a three months' General Staff Science Course at Shrivenham. The simplest basic science is followed by a broad study of the whole field of weapon technology. These students will have known the general difference between non-coherent pulsed doppler and clutter reference radars, even if it cludes them on arrival at Camberley.

The College runs specialist courses in guided weapons, nuclear science and technology, and ammunition because it is particularly well equipped and staffed to do so. It seems strange that these facilities are not more used to teach Sapper officers the fundamentals of nuclear power. Short courses have also been run, in the words of our last Commandant, for "Forward Brigadiers and Backward Major-Generals". It is difficult even for Sapper generals to keep up-to-date in the problems of the Army as a whole.

When he was DGMT, Lieut-General Sir Charles Richardson (Commandant RMCS 1955-58) obtained Army Council agreement to changes in the staff training of officers which are due to take effect in 1966. The main change is that all staff officers will do the one-year Camberley course and prior technical training at Shrivenham in accordance with their background knowledge. All those who have degrees in Science or Engineering and those who have received a reasonable grounding in science will do courses at Shrivenham lasting one year. The least scientific will attend a three-month short course similar to the present GSSC. Sappers should welcome this change, for it gives the scientifically educated officer and the graduate in particular, every possible opportunity for success. If he has character and self-confidence he should aspire to the highest command. If he prefers purely technical matters the whole field of weapon development lies open to him. In the first case he will be a more effective staff officer or commander because of his improved knowledge of weapons, and in the second he will take into the research and development machine a fuller military knowledge with which to guide policy.

In the past the Corps seems to have striven to be self-sufficient. The Royal Engineer technical staff officer felt as a result that he had deserted the true field of army engineering. If we prefer to discuss our problems only amongst ourselves, and to solve them privately, the other Arms of the Service will come to imagine that we have no problems and no useful roles to fill. Royal Engineer officers play a very big part in all aspects of College life from the rugger field to the arts. Only by a full understanding between other Arms and ourselves, can Sappers continue to play a prominent role in the Army.

# Earthquake Relief Work in Yugoslavia

By LIEUTENANT C. G. B. BRODLEY, MBE, RE

"Like human beings, towns are born, pass through their childhood to maturity. Sometimes, again like humans, they suddenly die . . . from a natural cause . . . or by human hand. . . ."

From The People's Republic of Macedonia, published in Skopje, 1961.

#### INTRODUCTION

AMONG the many international contingents that arrived in Skopje after the earthquake in July 1963 was an RE detachment. In this article I have attempted to outline the general problems peculiar to the situation and the work carried out by the detachment. The work of other detachments in the city, British and others, are touched on briefly in order to give a better overall picture.

I am grateful to Mr Whitley-Moran, MICE, and Mr Brian Long for their advice during the time they spent in the city and to Mr Morgenstern of the Imperial College of Science for information relating to the geology of the area and the mechanics of the earthquake. The technical detail is contained at Appendix "A" to the article.

### DEVELOPMENT OF SKOPJE

Since the Second World War, Skopje had grown from a city with a population of 50,000 to one of 200,000. The vertical lines of tall apartment buildings now dwarf the minarets of the mosques in the old town on the opposite banks of the River Vardar. After liberation in November 1944 the province of Macedonia, relatively isolated in the pre-war Yugoslavian system, was stabilized as The People's Republic of Macedonia and had made considerable progress, symbolized in the rapid development of Skopje. At the time of the carthquake, there were 36,000 apartments and dwellings and a further 4,000 under construction. The University of Skopje, founded in 1949, catered for 10,000 students and was the third largest in the country. Forty-five major industrial enterprises contributed to the employment of 44,000 people and industrial production in the city had risen six-fold since 1939. Forty per cent of the economic capacity of Macedonia was concentrated on the city.

To the people of Macedonia, Skopje was a symbol of their progress and development. Into it had gone the efforts of a people that felt themselves free for the first time since the Turkish occupation at the end of the fourteenth century. It was for this reason that the earthquake had a more profound effect on the country than might have been the case in an area with a greater diversity of industry and accomplishment. Skopje was a showcase in which most of the contents were destroyed.

## IMMEDIATE EFFECTS OF THE EARTHQUAKE

The earthquake of 26 July 1963 was the most recent of a series of earthquakes which have destroyed the city in the past. The earliest recorded disaster was in AD 518 and the town was again destroyed in 1555; less severe tremors were recorded in 1818, 1890, 1904, and 1921. At 5.17 am on 26 July two tremors lasting a total of 20 secs rendered 85 per cent of the dwellings unsafe. Most of the public buildings including those of the University were destroyed and fourteen major industrial concerns were severely damaged. As a direct result 1,400 citizens died and another 170,000 made homeless. Aid from all parts of the world was immediately forthcoming, mostly in the form of first-aid and medical supplies. These were undoubtedly appreciated, but the larger problem facing the authorities once immediate emergency measures were in train, was the rapid re-housing of the population. Sufficient accommodation had to be provided before the onset of winter to maintain Skopje as the centre of the Macedonian economy. This could only be achieved by a prefabricated housing programme on an enormous scale and a directorate was established to plan and co-ordinate the work.

# THE EARTHQUAKE

The geology of the Skopje region is very old. The city stands on the alluvial plain of the Vardar which is flanked by two outcrops of Palaeozoic origin. At the outer edge of the plain, running in a north-south direction are two very marked and severe fault systems. For some time past it has been known that the entire plain is gradually rising, a phenomena caused by a load transmitted from the strata in the east which are in a permanent state of compression. The load is transmitted through the alluvium to a line somewhere on the fault, there is then a tendency for slip to occur along the line of the fault and surface movement to be brought into the Skopje area.

Geodetic surveys undertaken in the USA and France immediately after the earthquake put the epicentre 10 kms NNE of Skopje and at a depth of 33 kms, on the co-ordinates  $42^{\circ}$  6' N and  $21^{\circ}$  30' E. The depth of the shock was unusually high and from the geometry of the figure meant that the fault must have a dip in a west-east direction and a value of  $60^{\circ}$ -90°. Subsequent field surveys confirmed this.<sup>1</sup>

<sup>1</sup> Since preparing this article for publication Mr Morgenstern has expressed the opinion that the earthquake was, after all, a surface shock. This opinion was based on the type of damage and geological structure of the area. The degree of correlation between the surveys of the USA and France was so high that it would seem unwise to dismiss them.

#### FOUNDATION CONDITIONS

During its lifetime the River Vardar has stabilized in four positions and there are four very distinct river terraces. The city is built on the youngest of these terraces which has the following strata; river deposits of alluvium and gravel; neocene sandstones; placocene sandstones and marls. The gravel deposit upon which the city is founded has a minimum depth of 6 metres in the west and this increases to a depth of 30 metres in the castern part of the city. The gravel has a bearing capacity of 4 tons per sq ft and it contains no soft clay. There is no cementing matrix and the gravel relies entirely on a mechanical interlock for its bond, but laboratory tests carried out after the earthquake did not reveal any loss in strength due to vibration.

### FAILURE OF BUILDINGS

The majority of failures occurred among newer buildings of more than one story, mass concrete and masonry buildings suffering most heavily. In all cases failure had taken place at the level of the first story and the material had passed out of the elastic and into the plastic range. The mode of failure was itself unusual, normally in earthquake failure there is an initial stress followed immediately by a reversal while the material remains *within* the elastic limit. Thus failure on both diagonals can be expected. In the Skopje earthquake nearly all failures ran in one direction, from bottom-east to top-west, indicating that both shocks had been in the one direction, thus increasing the absolute surface movement.

Discounting the older Turkish quarter where bad building practices contributed to the failure of many buildings, there were marked discontinuities in the amount of damage suffered from one part of the city to another. Given the geological conditions a fairly even damage distribution would be expected, but this was not the case. Three hypothesis were put forward in attempts to account for these discontinuities. Firstly, it was suggested that there was a buried channel beneath the city that varied foundation properties, but an extensive borehole programme conducted in the autumn months produced no evidence to support this theory, nor did it reveal any other discontinuity in the subgrade. The second suggestion was that different building methods and designs had been used in different parts of the city. This was not true. As is common elsewhere many types of design and types were scattered at random throughout the city and there was no reason why one area should suffer more heavily than another. Expert examination of typical foundation designs used over the past few years did not reveal any inherent weakness.

The third hypothesis was first put forward by Morgenstern of Imperial College of Science. He attributed the discontinuities in damage to the severe flooding that had taken place in the city the previous autumn. In extensively damaged areas the flood water had remained at a depth of 1<sup>1</sup>/<sub>2</sub> metres for a period of two days, whereas in adjacent and less heavily damaged areas it had cleared in a matter of hours. Where the water had lain for a long period it had penetrated into the subgrade, subsequently freezing and destroying the mechanical interlock by expansion. On thawing much of the fines material was washed away leaving behind a badly graded, latticed material that was considerably weakened. It was unfortunate that the subgrade was required to withstand such a severe shock so shortly afterwards, under normal conditions gradual settlement would have taken place and the material would have stabilized over the next few years. It was doubly unfortunate that one natural hazard should have contributed to the effects of the next.

## INITIAL PLANS

First estimates of the population required to maintain and rebuild Skopje were put at 120,000 and plans were made to house this number through the approaching winter. Though 85 per cent of all dwellings were unsafe, early assessments indicated that about 50,000 people could be accommodated in apartments that could be repaired before winter, leaving a balance of 70,000 people for whom new homes had to be provided. The directorate established to co-ordinate and plan this work was greatly assisted by the existence of plans outlining the development of the city over the next fifty years. These plans had existed for some time and though not in any way complete, provided a basis for the rapid planning that was then required. Basically they envisaged a number of dormitory suburbs in areas outlying the city and connected to it by broad arterial roads. It was decided that temporary accommodation should be erected at eight of these locations providing dwellings for 60,000 people. This left the centre of the city clear for the task of rebuilding. The planned life of the settlements was to be from ten to fifteen years and all the roads, main services, and facilities were to be installed from the outset, thus avoiding duplication of this work in future years when temporary accommodation is replaced by more permanent structures.

These decisions were first released in a bulletin dated 13 August. Predictably there was some criticism of the decision to build the city in the same location, but for economic and geographic reasons there were no alternatives to the present site. Most of the city's services and facilities, especially water supply, drainage, electricity, and roads were untouched by the earthquake and sufficient remained to constitute a large saving as the new city is built. As it was, unofficial estimates put the amount of damage at £200 million. The city also stands on the only crossing place on the Vardar for many miles and it was argued that improved techniques in earthquake design and construction would make the future city safe from tremors of the magnitudes so far experienced.

Once these decisions had been made, their implementation raised a host of problems, chief among them being the provision of such a large quantity of prefabricated housing. A total of 900,000 sq metres of new floor space was required; of this amount Yugoslav enterprises had contracted to supply 600,000 sq metres, though to do it some firms were having to increase their output five-fold; 200,000 sq metres were to be obtained by Yugoslav purchases abroad, particularly in Scandinavia, and the remainder was to come from foreign gifts in kind.

### BRITISH GOVERNMENT AID

In the first few days following the disaster there was some criticism of the Government's slowness in offering aid to the devastated city. Newspaper correspondents who had visited Skopje felt that aid should have been more immediate; the Americans had sent a field hospital in twenty-seven Globemasters the following day and this was operating within 72 hours of the disaster; many planes carrying plasma, medical supplies, food and blankets arrived hourly; and promises of financial aid were coming in from all parts of the world. In fact these criticisms were not justifiable. Throughout the period immediately following 26 July the Government was kept informed of requirements, and though gratefully accepted, much that was sent to the city was not required. As happened in the Persian earthquake in 1962 much of the relief was misdirected. The announcement on 1 August that twenty-four Nissen huts were to be sent to the city by the Government was among the first concrete offers of help towards solving the large rehousing problem. It was at this point that the Royal Engineers became actively involved in the work in Skopje. Late in the evening of 2 August authority was given for the despatch of a small party of NCOs to Skopje to supervise the erection of the huts. On the morning of the earthquake the two regiments of 11 Engineer Group were widely dispersed. 25 Corps Engineer Regiment was at its Bridging Camp at Hameln while 35 Corps Engineer Regiment was engaged on Troop Circus; a troop competition consisting of a gallop round the German countryside carrying out engineering tasks. It was not until their return on 28 July that they knew of the earthquake and many were hearing of the city for the first time.

The despatch of an officer, a senior NCO, and five juniors would not seem to present many difficulties. However, this was the first occasion that British troops had served in Yugoslavia in peacetime; that to get there meant a journey through neutral Austria; and it was August Bank Holiday. Eventually, after much discussion between HQ BAOR, War Office, and the Regiment about the mode of transport, dress to be worn in Yugoslavia, and stores to be taken, the following brief emerged which was based on the situation known at the time:—

The party was to move by train from Dortmund station on the morning of Wednesday, 7 August, and travel to Belgrade where it was to be briefed by the Chargés d'Affaires; both the MA and the Ambassador being on leave. Its orders were to build a sufficient number of huts to give the Yugoslav engineers and workmen enough experience to be able to complete the project on their own and to hand the work over to them at the earliest possible moment. This definition of the RE task was always maintained. The maximum length of stay in Yugoslavia was anticipated as ten days. In evolving this brief several assumptions were made which at the time seemed very reasonable; firstly, that there would be no shortage of competent engineers to handle this work should we withdraw, secondly, that there would be a supply of either English-speaking engineers or interpreters capable of passing on instructions and explanations, thirdly, that the huts would be used as very temporary accommodation in a single camp-site and could be founded on timber sleepers or some other form of rapid foundation.

The 36 hour journey from Dortmund to Belgrade was not without incident. Yugoslavia does not have full diplomatic representation in West Germany and clearance had to be obtained through the two Yugoslavs who represent their country's interests from the Swedish Embassy. There was no time for a personal visit to collect a frontier pass and arrangements were made for it to be delivered by hand on Bonn Station. To aid the rendezvous I had to lean out of the window at Bonn whereupon one of the Yugoslavs ran the full length of the train and passed up a letter. It was completely unintelligible to me, but it did the trick at Jesenice on the Yugoslav frontier!

Diplomatic clearance through Austria had been obtained prior to our departure but we arrived at Salzburg at 2 am and something had gone wrong with the "all-informed" arrangements. The Customs official whose duty it was to stamp our passports was most upset by our uniforms and obstinately refused to allow us to proceed. All the documents we possessed were produced, including Green Card Insurance and Yellow Fever and Smallpox certificates, but he remained unimpressed. The scheduled stop of the Trans-Europa-Express is 27 minutes. After 40 minutes the situation was becoming desperate and every official on the station was either making telephone calls or were interested spectators. Finally, ignoring all protests and followed by an assortment of uniforms, I took them to the luggage compartment. Having explained that 7 tons had to come off the train before we did, they capitulated and the Express was allowed to leave with us on board, 30 minutes behind schedule.

#### THE SITUATION IN SKOPJE ON ARRIVAL

With no previous experience of earthquakes or large-scale devastation, it was difficult to anticipate what Skopje would look like on arrival. First reactions were that the amount of damage sustained had been exaggerated. It was true that some buildings had collapsed in a spectacular fashion, in particular the railway station, the officers' club, and one or two apartment buildings. Closer inspection showed that practically all buildings left standing had suffered severe interior damage. Floors had collapsed and so few were considered safe that entry into any building, even to collect personal belongings, had been prohibited. A curfew had been imposed to prevent looting, though there were very few instances of this, and driving through the city on the evening of our arrival was like driving through a ghost town. The emotional impact of the disaster was lessened by the evacuation of most women and children from the city in the days following the carthquake.

Nevertheless, 120,000 people were living in tents, crected in the streets, in the gardens of houses, and in every available open space. Everywhere people tried to lead as normal a life as possible with the few facilities left to them. Shops took their wares onto the pavements, barbers set up in the street and families cooked alongside their tents. On reflection, this was the real tragedy of Skopje; in the Italian flood disaster that followed in October, though everything was devastated and the toll of human life was greater, few were left to mourn the loss. In Skopje sufficient remained for the inhabitants to struggle on among the ruins of their homes.

Within an hour of our arrival in the town contact was made with the Planning Directorate and a decision made as to the best uses for the Nissen huts. At that time the Yugoslavs had little knowledge of the form that other aid would take; Republics within the country had contracted to supply bulk areas of floor space of unspecified forms of prefabricated housing and other promises had been received from abroad. The only exception was Dexion Ltd, who had materials and engineers in Skopje on behalf of War on Want. The uninterrupted floor space of the 24 ft Nissen is 147 sq metres, too large for private accommodation, but ideally suited for communal buildings. It was therefore decided that the huts, with modifications, should be used as schools in three of the planned settlements. To save further delay, the first site at Djorce Petrov was allocated immediately. The Djorce Petrov settlement was planned to accommodate 12,000 people and was to be built from foreign gifts; by far the largest proportion being supplied by War on Want in the form of Dexion framed houses. After a night spent in a central encampment the detachment moved to Djorce Petrov on Saturday, 10 August and set up camp.

#### THE ARRIVAL OF THE FIRST NISSEN HUTS

The following day the site at Djorce Petrov was set out. That afternoon the first consignment of stores from the UK arrived; in view of the criticism that had earlier been made, it should be pointed out that these twenty-four Nissens were the first complete buildings to arrive in the city not only from outside the country but from within Yugoslavia as well. They had been driven across the Continent in a convoy of articulated lorries and trailers and the reaction of onlookers as these juggernauts drove into the city and assembled in Marshall Tito Square was most encouraging. Each of them was labelled "British Aid to Skopje, Britanska Pomoc Skopje", and it was a shame that there was no one present in a position to put their arrival before the British public either in the Press or on TV.

Using voluntary student labour drawn largely from Skopje University, these stores were unloaded at the three school sites, Djorce Petrov, Butel, and Madari. At the same time the excavation of the footings of the first school were begun using a labour force of forty provided by a Macedonian contracting enterprise. In the early days of August nearly 1,000 university students were employed in the area. Organized into brigades of sixty they worked in two shifts of six hours each. They dug excavations, shipped rubble and moved stores for twelve hours a day. Their enthusiasm was tremendous. Wherever they went, riding in the back of Yugoslav Army trucks or parading down the roads towards work-sites behind their flags they sang songs of rebuilding a new Skopje. Many had lived in Skopje and had lost their homes in the disaster. Through their enthusiasm they gave much impetus to the programme and many of the brigades received decorations from President Tito at the end of 1963.

# ORGANIZATION OF THE TASK

After only three days in Skopje major differences between the task we had envisaged in BAOR and the task we were asked to perform had emerged. As schools these huts were to have a planned life of up to fifteen years and were to be founded on concrete. Further, these foundations had, by local building regulations, to be dug at least 70 cm below ground and extend 30 cm above because of the severe Maccdonian winters. For the same reason, the cavity between the inner and outer linings was to be packed with fibre glass as insulation. Both these factors made the work vulnerable to local material shortages. Also, instead of one site, there were to be three at considerable distances apart; and instead of an abundance of engineers and interpreters, there was a scarcity of both. There was no question of refusing their requests or referring them back, and it was evident that a return to Germany by 29 August was out of the question.

The feasibility of an early hand-over to Yugoslav engineers was complicated by the organization of the task. Responsibility for each of the eight planned settlements had been accepted by one or more of the six Republics which constitute Yugoslavia. Djorce Petrov was to be built by Macedonians using Macedonian enterprises, labour, and plant; Butel by Bosnia and Herzegovinia, and Madari by Croatia. There was a considerable amount of civic pride and prestige involved in making rapid progress, and in moving from site to site we changed site engineers, foremen, and labour. Some enterprises were well equipped, others were not; some had experienced labour, others had drawn their labour from wherever it could be found. This made continuity between sites difficult and, wherever possible, foremen and tradesmen spent a few days working an existing site before work was commenced on their own.

As we were providing only the schools for these large settlements, our task always formed a small part of a much larger project and became a subcontract for the main contractor. This was inevitable, but it meant that labour and equipment had to be won from the main task. Plant was always in short supply and had scarcely been sufficient to meet normal developments. In this new situation it was hopelessly inadequate and not until later when fresh purchases had been made, did the situation improve. Scarcity of Yugoslav engineers made site supervision and direct intervention with labour difficult, but as our experiences increased so did the control. In a very short time the corporals had their own version of the local language and two were always sufficient to supervise and control one of the schools sites.

On 13 August, British Government assistance increased by another twenty Nissen huts, and the Embassy requested that the detachment should stay in Yugoslavia until these additional stores had been sorted and construction started. These stores were arriving by sea and were due in Skopje on 14 September.

## Assistance by War on Want

Shortly after the earthquake War on Want committed itself to providing £100,000 of aid to the city, prior to any public appeal orders to this amount were placed with Dexion, Ltd. Dexion is familiar as a conveniently slotted and light-weight material suitable for shelving and supporting wireless sets in the back of Land Rovers. However, the company had developed designs for prefabricated houses and these had been used with considerable success in the crash housing programme that followed the Persian earthquake in 1962. Roof trusses and portals are constructed on jigs and then erected in a central area, each truss being connected by longitudinal members. The structure can then be carried to the site ready for concreting and cladding of the frame. With the money, War on Want aimed at erecting 1,600 of these houses. Transport costs were being paid by the Government and cladding and services were to be provided by the Yugoslavs from their own resources.

Richard Dimbleby helped launch the appeal on television at the beginning of August and the subsequent response far exceeded expectations. On 15 August we learnt in Skopje that the appeal had already passed £300,000 and was still rising. Dexion, already committed to capacity, was unable to provide further material and some other form of aid had to be found. To assist the Yugoslavs with their purchase of asbestos cladding within the country a gift of £150,000 was made, but this still left a large surplus. The War Office was approached with regard to the purchase of more hutted accommodation and at the end of August, War on Want's Chief Administrator, Mr Frank Harcourt-Munnings, and Lieut-Colonel J. St J. Baxter of HQ ESE, arrived in Skopje to advise the Yugoslavs on the materials available.

The only material that could be made available was that surplus to WD requirements and consisted mainly of Nissen hutting. In August, full of confidence that the housing target could be reached in the time available, the planning authorities were willing to sacrifice some speed for elegance of design. They were concerned with the erection of townships that were to last fifteen years and their preferment for something other than a Nissen was

understandable. War on Want felt that, since the Nissen huts were immediately available and could be moved and assembled rapidly, they should be used. Further it was possible to provide a much greater covered area from the funds available by using Nissen huts, sufficient to build two 1,000-man camps were purchased. There is no doubt that the War on Want view on this was the correct one, but in pressing it a certain amount of prestige was lost. The Swedes had built eleven, fully equipped accommodation blocks; the West German Red Cross erected forty family dwellings, with all the fittings included, and the Danes had put up eighty small huts, each of them to sleep five and equipped down to toothbrushes and toothmugs. This was most impressive, but War on Want's main concern was to provide cover for as many as possible. No doubt fewer and more elegant houses fully equipped would have boosted prestige, but they would not have housed as many people. Out of a total of 100,000 sq metres of floor area provided by foreign aid the British contribution was 81,000 sq metres. With a new commitment of 160 16 ft Nissens and forty 24 ft Nissens, War on Want asked the War Office for more Sapper assistance.

It was obvious that the original small party would not be large enough to cope with the new task envisaged and that some reinforcement was required. Although ideally one would have liked a complete regiment with all its plant this was not economically feasible and it was decided to continue the procedure already adopted, and use sappers to supervise Yugoslav labour. Eventually a Field Troop with a number of attached senior NCOs was sent and was sufficient to give an organization of two seniors, two corporals, and twelve tradesmen to each camp site, backed by a small HQ element of an administrative officer, a works officer, clerk of works, and a stores sergeant. With the exception of the two last the entire detachment was drawn from 95 Corps Engineer Regiment and the majority were from 9 Troop of 42 Field Squadron. The arrival of the detachment was timed to coincide with the consignment of Nissen huts expected from BAOR at the end of September.

# THE CONSTRUCTION OF THE SCHOOLS

Meanwhile the work of constructing the schools continued and by the middle of September the first three had been handed over to local contractors for the installation of services and the modifications that were to be carried out. Some of these Nissen huts had the finest interior of any built, all of them had either a parquet or tongue and groove wood floor and when completed looked very well indeed. To each school built, the Corps presented a lectern that had been made in the BAOR workshops and which had the Corps badge mounted on the front. It had been hoped that Sir Michael Creswell, the British Ambassador in Belgrade, would be able to formally hand over a completed school before the departure of the detachment, but as the schools were scheduled to serve settlements that were still under construction, we never saw them occupied. In fact at Madari the eight school Nissens were for a long time the only buildings on the site, there cannot have been many schools built with nobody to attend them! The stores for the final two schools were delayed and did not arrive until late September. These were erected at Karpos and Cair and were handed over to the Yugoslav contractors for completion in mid-November.

The erection of these five schools occupied the original party over the first two months of their stay in Yugoslavia. The schools were intended to be

used in two shifts, one class in the morning and a second in the afternoon. and the education authorities planned on having eighty pupils in a hut, forty in each of the two classrooms. On these figures the Government's gift provided school accommodation for 7,000 children. The NCOs responsible for supervising construction had some unusual problems to face. When working in another country with totally inexperienced labour, and frequently without the use of an interpreter, it requires a great deal of determination and pertinacity to see the job done correctly and well. Staff Sgt Richardson and Cpls Prettyman, Peters, Page, Crankshaw and Owen never failed to do this and though at times their sense of humour may have become a little twisted the job always got done. We soon learned that the Yugoslav, or at any rate the Macedonian, was far too polite to say "ne mange" or "it is not possible"; with all the goodwill in the world they promised everything that was required . . . "sutra" or "tomorrow". The words "sutra" and "pevo" (beer, of which we were given a free issue of thirty bottles a day) very soon passed into our vocabulary.

## PLANNING THE ERECTION OF THE HUTTED CAMPS

While the schools were being completed work was in hand on the two large camps that were to be built. The two largest engineering contractors in the city, although heavily committed on other sites were recruited to do the job and at a meeting on 6 September, at which the Commanding Officer of 35 Regiment, Lieut-Colonel B. J. Coombe, GM, was present, their representatives were handed the estimates and specifications for the work. It was agreed that work should start on 29 September, the earliest date practicable, with a hundred men at each site.

There was immediately a rush to find suitable sites for the camps. The basic layout for them had been taken from Military Engineering Vol VII, Part VII; and this had been modified to suit Yugoslav planning and also to cut down the area of land required. By this time most of the land in the settlement areas had already been allocated but it still required a fair sized plot to build one hundred Nissen huts. In an area that was developing as rapidly as Skopje it was also as well to check on other planned developments before going firm on a site. One site that was allocated to us by the Reconstruction Directorate had been scheduled for a new motorway by the Town Planning Authority and the prospect of trying to dodge a non-existent road did not appeal. At another site people were arriving with building permits issued by their local council and loads of bricks, two days after we had started our setting out. This sounds like utter confusion but the tremendous amount of planning work necessary in the first six weeks made some confusion inevitable. Two sites were finally secured at Madari and Dovietjka Potok, a name that was much too difficult to telephone in Sitreps and that was always translated and known as Girls' Creek.

The reinforcement party under the command of Captain S. L. Rooth arrived in Skopje on 27 September and were faced the following Monday with the unpleasant prospect of unloading the consignment of 150 16 ft Nissens that had arrived over the week-end. There was not the space or the time to break-bulk at the goods yard so the stores were despatched to the sites in what was hoped the correct proportion. Much of the next week was spent redressing the balance and sorting the stores into hut lots. The unloading and movement of stores focusses one of the chief problems that every-



Photo 1. The stores area at the Girls Creek site, some of the seventy-six small and sixteen large Nissen huts that were erected. Every item on this site was moved by hand.

body that worked in the city faced; a very severe shortage of transport and handling equipment. Every item of the 1,013 tons of stores received was unloaded by hand.

All the stores received by the detachment were banded into packages designed for mechanical handling, too heavy to be man handled. At the Skopje railhead, as late as November, there were no cranes, consequently bundles had to be split and the sheets unloaded a few at a time. A similar situation prevailed on the sites where there was often not even a spare lorry to assist in the movement of stores. At both sites there were permanent stores shifting gangs whose sole job was the movement of stores from central areas to the hut sites. Men carrying 10 ft 6 in curved sheets of corrugated iron on their backs look like strange tortoises. Eventually there were seventy-five huts neatly lined up on each site and though this was not the complete committment it was quite sufficient to keep the detachment occupied. With the stores present and sorted it was possible to get on with the main task of erection. Progress on the site, and indeed throughout the city, was entirely dependent on four main factors: the availability of labour; continued supplies of some materials, especially aggregate, cement and fibre glass; transport and handling facilities; and the weather.

#### THE EMPLOYMENT OF LOCAL LABOUR

In October, a time when all sites were working flat-out to achieve completion by the year's end it was estimated that the city required 11,000 workmen for repair and construction work. The number actually employed was only

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7,000. In the competition to attract labour Macedonian firms working with foreign material were most badly placed. In the case of the camp-sites the firms had contracted to erect the Nissens for a fixed sum and rising labour costs left them facing a deficit. Consequently, throughout October there was insufficient labour at both sites and progress was at times exasperatingly slow. This was aggravated by the presence in the city of large numbers of unemployed men, existing on Government aid given to earthquake victims. At a time when there were only seventy men at Girls' Creek instead of the 150 required, the Yugoslav engineer responsible for the site said, "Most of them look for work praying they won't find it". On reflection one cannot imagine professional men in the UK becoming labourers under the same circumstances.

These conditions eased in November when peasants from neighbouring villages came into the city seeking winter employment after the harvest. They were inexperienced but they were capable of assembling Nissen huts and progress showed some improvement. Most of them lived on the site, occupying the huts as they were completed. Their wages were small, 25,000 dinars (£12) a month, but this was not much below the national average. It was impossible to organize their work on an economical basis. Normally about ten or more would work under one ganger and once a hut was started each gang showed an obstinate desire to finish it; they regarded it almost as their own property and attempts to organize rib and purlin parties, innerlining parties and so on were eventually abandoned. This made it very easy for the contractor's accountant who paid each gang on the number of huts completed. The labour cost for erecting a 16 ft Nissen hut was about £25.

# THE SUPPLY OF MATERIALS

We had originally hoped to be independent of local supplies in completing the RE part of the task, but the introduction of large concrete foundations and fibre glass as insulation made our progress dependent on the availability of these materials. As demand grew in the city so our dependence became more accentuated. In August work on the first three schools was seldom delayed for long and shortages were generally caused by lack of transport, not materials. As more and more sites were developed shortages in supply of materials became more common.

The first material to become scarce was aggregate. The amount of plant necessary to winning the aggegate was limited and transport for haulage was in short supply. In this respect the Russian Engineer Battalion working in Skopje performed a valuable task. Convoys of their large tippers ferried aggregate through the city constantly, mainly for use in road construction. On the smaller sites engineers were faced with the problem of using the aggregate they could get to make up their roads before concreting, or to take a gamble on the weather and to press ahead with foundation work. With heavy rains expected in October and November the latter course was risky and we discouraged it. Though the weather was unexpectedly kind, some sites in the city later regretted the poor regard they had paid to their roads. With the short time available nobody could be blamed for taking risks like this; the ultimate criteria in assessing a site was always, "how many buildings have been completed?"

With aggregate we were fortunate and there was always just sufficient to keep the labour employed. The material that effected our progress most was



Photo 2. Cpl Lampard and Cpl Atkinson supervise the erection of a gable end by Omladina (volunteer labour).



Photo 3. A pair of semi-detached bungalows of Dexion frameworks being carried to its foundation by forty-four university students. Eight hundred such units were constructed in the space of a few months.

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fibre glass. Only one factory in Macedonia produced fibre glass and that had an output of only 2,500 sq metres a day. Our requirements alone totalled 25,000 sq metres and once stockpiles ran out it was simply a matter of waiting one's turn. Delivery of fibre glass to the sites was always something of an entertainment; workmen would leave the huts they were building and rapidly unload the material, rushing it to semi-completed huts they had had to leave. Only by completing them could they be paid for the work they had done.

## THE SHORTAGE OF TRANSPORT

The chief bottle-neck in maintaining supplies of any material was the inadequacy of the transport system within the city. Five years before, Skopje had been a provincial town, more used to bullock carts than motor traffic and the roads within the city indicated this. Since the completion of the Belgrade-Skopje autoput the traffic density had risen sharply and traffic control within the city presented new problems. Skopje was also served by the Belgrade-Athens railway line and, in addition to the main passenger station destroyed in the disaster, there was a new goods yard at Madari. Despite these improvements the handling facilities were never able to cope with the volume of material arriving in the city once the majority of new settlements were under way.

Steps that could have been taken to case the situation were not always implemented and the lack of co-ordination of rail and road services made distribution difficult. It should have been possible to have installed cranes at the railhead during August that would have speeded the unloading of freight during the autumn months, thus reducing the number of wagons, at one time as many as 700, waiting to enter sidings. This was not done. In such an emergency, and given the difficult traffic conditions in the city, it would have been prudent to have regulated the entry of traffic to those vehicles actively engaged in the maintenance or reconstruction of Skopje. There was sufficient of these alone to cause heavy wear and damage to the roads without the additional load of non-essential traffic that was allowed access. In the four months the detachment was there, the road passing the railway station twice needed repairing and one minor road leading to two important sites collapsed completely into an underground stream. Despite the efforts made by the local authorities there were times when early action would have saved much subsequent work.

# THE FINAL CONSIGNMENT

On the 1 November the final consignment of stores necessary to the completion of the task in Skopje arrived from Thessalonica. They included the forty 24 ft Nissen huts, the water tanks and towers, and the water supply fittings for the camps; none of which had been available to us from BAOR. A great deal of credit was due to the UK stores organisation for assembling the consignment and ensuring that the detachment received what it required. Stores had been drawn from all over the place and there were only two trivial instances of the wrong stores being received. The first was when chimney elbows were sent from the UK to support pipe-sets supplied from BAOR. BAOR sent us cast iron pipes, while UK despatched sheet metal elbows, the resulting assembly was a little unstable! Apparently, too, there is a correct way of hanging a door according to the direction of the diagonal supports; this meant that there were right-handed and left-handed doors which should be supplied with their respective locks. There was some confusion here which resulted in all the locks on one site being fitted upside down, a feature that was explained to the Yugoslav engineer by a site-senior telling him that they were manufactured in Australia! At one time we thought we were deficient of several hundred sheets of corrugated sheeting but this eventually turned up. It had been checked off the boat by a driver under the item "Wriggly tin".

Once the task of getting these stores on to the sites and sorted was complete, the major part of the Sapper task was done. By this time the labour was sufficiently proficient at Nissen construction to be capable of working alone, the only supervision required being to maintain standards of workmanship. The final major item was the erection of the water towers and tanks and the installation of the water supply system. For the latter we accepted responsibility from the outlet from the tank to the stopcock outside each building. The supply to the tank and the internal arrangement being left to the Yugoslavs.

The tower foundations for the two water tanks were cast as a complete continuous slab early in November and erection of the towers began in the middle of the month. It was a task that suited the Sappers admirably on each site at a time when the need of their supervision was falling away. At Girls' Creek the 30 ft tower was erected by half a dozen men under Sergeant Hambrook in a total of twenty hours but they were then delayed considerably by a lack of lifting equipment to place the decking beams. The enterprise could only produce an "endless-chain" of 8 ft lift and each stage was 10 ft. The problem was finally resolved by the local purchase of a block and cordage. Once the decking beams were positioned the pressed steel tanks were rapidly assembled and the long and tedious process of tightening-up began. At Madari a long delay was caused by the only serious stores deficiency that we experienced; a quantity of bolts were missing from a box of small stores, and those missing unfortunately included the long anchor bolts without which construction could not proceed. We asked for them to be purchased in the nearest local equivalent expecting this to take one or two days. The bolts finally arrived eleven days later, every one of them having been made by hand at a blacksmith's forge. Instances such as this bring home how much we take for granted in the UK.

# PROBLEMS CAUSED BY RETURNING CITIZENS

The target date for completion of the task was 1 December and though at the beginning of November this appeared extremely optimistic the rate of progress improved considerably throughout the month with the result that we were able to hand over both camps to the Yugoslav contractors for completion on 28 November. Their task had been considerably increased by a late decision to use the huts for family accommodation. Throughout the autumn months many people returned to Skopje. They came back for many reasons; mothers with children under 7 who had been compulsorily evacuated after the earthquake returned to join husbands still working in the city. Though tremors continued until well into October (over 400 were recorded) they were diminishing in intensity, and whilst the weather was still warm many were encouraged to return. The peoples of Yugoslavia do not have a common cultural background, nor even a common language, and it was difficult for a Macedonian to live elsewhere; throughout October and September thousands returned. Ten weeks after the earthquake there was an estimated population of 160,000 in the city and the housing target remained at 120,000. On the 5 November there were still 25,000 people living in tents, a time when heavy overnight frosts were becoming common.

A major reason for this influx was the belief that the absence of a family naturally prejudiced the chance of being allocated a house once they were completed. Many families returned and lived in tents their names being entered on a central register maintained by their council. The presence of these people swelled the numbers of unemployed in the city. The first major settlement, that backed by War on Want and Dexion at Djorce Petrov, was not handed over to the civic authorities until 15 December after the detachment had left, and we did not witness the manner in which the houses were allocated; probably the most interesting social-political event of the entire operation. One Belgrade newspaper did publish a list of the criteria to be used but these were immediately refuted by the Skopje City Assembly. High on the list was "Active membership of Veterans and other social organisations".

This enlarged population naturally increased the demands placed on the city administration and it was a puzzle why a society, that could evacuate 80,000 people in the first week after the disaster, should, under the circumstances, permit their return. Administrative and supply problems would have been greatly reduced had some form of immigration control been established in September. As it was 40 per cent of the city's previous facilities were attempting to cope with 80 per cent of the previous population and shortages of bread and other commodities did occur from time to time. However, for some time past it had been the declared aim of the Macedonian Government to make Skopje the third largest centre in Yugoslavia after Belgrade and Zagreb. Compulsory financial aid had been diverted from the more wealthy areas to these that were less developed, much of it destined for Macedonia. The drive to establish Skopje as a centre of the economy was being achieved, to have substantially reduced the city's population for any length of time would have meant a great loss of impetus in this drive. Rather than be separated, men may well have left the area to seek work elsewhere and local industry, so recently established and already suffering from damage caused on 26 July, would have been further handicapped. While planning continued to be based on an active population of 120,000 no positive measures were taken to restrict it at this level.

It was against this background that the decision to use the hutted camps for family accommodation was taken. Each camp became a self contained village, one cookhouse block was retained and the other was converted into a self-service store selling most essential items. An additional four 24 ft Nissens were allocated to each site and a small school erected. For our part the decision did not materially effect the work but the contractors had to partition the huts and greatly increase the capacity of the water and electricity supplies to the camp.

## AID FROM THE ROUND TABLES OF BRITAIN

We did see the allocation of the first fifty caravans presented to Skopje by the Round Tables of Britain. These were distributed to the Opstinas (local councils) by the City Assembly in proportion to the amount of damage each had suffered. The Opstina was then responsible for their detailed allocation. On this occasion the main considerations were: that the family must have lost its' home in the earthquake; that the worker was actively employed within the city; and priority was given to those families with children that had lost a parent.

Some tribute is due to the organisation and men that made possible the delivery of some one hundred caravans to Skopje by Christmas. Very little was said in the British Press of their efforts, yet the provision of a stream of caravans through the late autumn months was, of all the aid, the most immediate and imaginative. Each caravan was ready for occupation on arrival and they made no demand on the severely stretched construction programme. Typical of all the caravans was that sent by the Round Table of Deal. It arrived in Skopje on 17 November having been bought for £200 from a dealer who had been knocked down from £250. It was then towed across Europe behind an ordinary family saloon, driven in turns by a banker, a photographer, a motor-mechanic and a plumber. When they left UK not all the money had been raised but they hoped that a football match arranged between the town Garrison and the TV All Stars XI would clear their deficit. After a very short stop in the city the caravan was handed to a Red Cross official and the party started their long haul back. It was not possible for the Yugoslavs to meet all such parties with the ceremony they would have liked, but there is no doubt that these gifts were greatly appreciated, both by the authorities and by the people who eventually occupied them.

### DEPARTURE OF RE DETACHMENT

With the Sapper task coming to an end arrangements were made for our departure. The detachment fulfilled a long-standing promise during November by building a house for one of the interpreters. By local building regulations the size was restricted to 4 metres by 7 metres so that "house" is a euphemism; it was, however, a great deal better than many such temporary dwellings. "Old John", as he was known to everybody, had worked in British Forces canteens in Egypt during the war and was a tremendous Anglophile; he served as one of our interpreters from mid-August until the detachment left. The house built for him was made up of spare ablution shelter frames, Nissen windows and doors, fibre glass won from various sites, and a hardboard lined interior that a Yugoslav contractor was persuaded to relinquish. He was also given the pig that the detachment had fattened through the autumn and which, on the day of reckoning, no one had the heart to kill.

Our task was finished on 28 November, the day before the Yugoslav National Holiday marking the formation of the Socialist People's Republic. The Macedonian requires little excuse for a party and here was double justification. The city Assembly gave a party for the detachment at which each man was given gifts to mark his association with the city. The detachment gave a party for the Mayor and the liaison staff and engineers who had worked with us; invitations were received for Republic Day celebrations and the Camp contractors gave a party for the detachment. Perforce most of these celebrations took place in the Saraj, one of the very few hotels in the city still functioning and strategically placed a mere five minutes from our camp.

Eventually the detachment were put into a first class railway carriage supplied by the Yugoslav railways, along with a liberal supply of the local wines to sustain them on the 36-hour journey back to Osnabruck' During its time in the city the detachment supervised the erection of 244 huts covering 22,000 sq yds; used 6,000 cu yds of concrete; placed 13,600 purlins on 2,200 rib sets and secured 40,000 sheets of corrugated iron with 27,000 nuts and bolts and 100,000 drive screws. Mercifully we were never asked to account for them!

#### CONCLUSIONS

In an article of this type which sets out to relate a series of events there is little need of conclusions, but there are one or two points that are worth setting down for future reference.

Public Relations. A great deal of good Army publicity was lost by the lack of a PR representative in Skopje in August. When Sgt G. Tollefson, a public relations officer from Southern Command, did arrive in Skopje in October he did an excellent job. He was, however, reduced to writing "local-boy" stories whereas in August he could have been writing for the National Press. From the success of the War on Want Appeal, over £400,000 finally being raised, there is no doubt that Skopje caught the public imagination.

Form of Aid. The provision of aid to Skopje was humanitarian and in no way political. We were not there to boost British prestige but to provide accommodation for people who had lost their homes. It was not really possible to separate the two, especially as in this case we were the first British troops to serve in the Republic. There were occasions when Skopje citizens felt that Britain was not sending what the citizens of Skopje deserved. The practical advantages of Nissen huts cannot be denied but when a modern and beautiful city is destroyed it is not always practicalities which weigh most. In such instances "morale-boosters" can be as important, especially from outside the country. The Danish huts, with their interior finish and fittings, created an impression out of all proportion to the number they could accommodate. It is true that the Dexion houses looked very well when completed but the finishing touches were provided by the Yugoslavs. Perhaps in future operations the organisations involved would be wise to bend their humanitarian principles sufficiently to provide one or two show-houses that would effectively fly the flag.

Equipment and Plant. If ever again the Corps undertakes a task of this nature in an under-developed area every effort should be made to provide the detachment with some plant. This makes the work rather more independent of local availability and gives to the detachment commander greater control of the work. Two light wheeled tractors and two concrete mixers would have eased the tasks on the camp sites enormously. At Girls' Creek 2,000 cu yds of concrete was hand mixed and every stores item was moved by hand. One or two items of plant would have constituted an enormous saving in man-power. When the American detachment arrived in mid-November to erect 250 Quonsets we were very envious of their transport and handling equipment.

Use of Troops. Some aspect of the use of troops in tasks of this nature were discussed in an article "The Unconventional Sapper" by Lieut-Colonel I. T. C. Wilson in the December 1963 issue of the Journal. The use of soldiers, especially Sappers, is very well suited to this type of task. When the responsibility which they had assumed became clear to them, not one abused it and practically all proved equal to the task. Using a mixture of soldiers English and Yugoslav, many controlled and efficiently organised the work of a dozen to twenty Yugoslavs, and were as much concerned for the completion of the task as the Skopjeans themselves. As a Corporal said to Richard Dimbleby when the Panorama team visited the camp: "It is much better work than building a Bailey bridge and taking the bastard down again". They felt themselves personally involved and took great pleasure in being in a position of providing something that was to be put to a manifestly worthwhile use.

Off duty the men, who were always in uniform, were allowed to mix freely with the local people and built up an enormous fund of goodwill by their smartness and bearing, and by their general behaviour. No abuses of the freedom they were allowed occurred. In contrast the Russian troops were never allowed into the city off duty.

The entire operation created a great deal of goodwill between the Yugoslavs and our own troops. For our own part it was a job which everyone enjoyed doing. It gave every soldier a definite sense of purpose, provided a shot in the arm for the unit, and gave the Army a good deal of publicity. In the past British soldiers have been known as our best Ambassadors. Perhaps there is an opportunity in tasks of this nature for them, and especially the Corps, to resume this role.

## APPENDIX

## THE FAILURE OF BUILDINGS IN SKOPJE

Skopje is a city of very recent development and most of the apartments have been constructed in the last decade. The majority of these apartment blocks are of the "high-rise" type, and heights vary between five and fifteen floors. There is an insignificant amount of new detached and semi-detached houses of the normal type, though much of the city's pre-war housing was of this type; especially in the older, Turkish quarter.

The earthquake of 26 July was widely reported as being of "10 degrees magnitude". Since this was rarely related to any scale it had little meaning. There are two scales commonly used by seismologists in assessing the powers of earth tremors. The Richter scale attempts to assess the energy release from seismic readings taken at stations around the world; the other scale, the Mercali scale, is concerned with the assessment of property damage. Both scales are logarithmic. It is thought that the Skopje earthquake had a magnitude of 6 on the Richter scale (the 1962 Chilean earthquake was one hundred times greater, ie magnitude of 8) and a rating of 8–9 on the Mercali scale. The earthquake did not, comparatively speaking, have a high energy release, but it did cause a great deal of damage.

A second confusion which frequently occurred was that between "epicentre" and "the centre of seismological damage". It was widely published in the world press that the epicentre was directly beneath Marshal Tito Square, this was not so. There is no doubt that the square was the centre of seismological damage but the epicentre, the centre of the energy release, was 10 kilometres NNE of the city. It was difficult persuading Skopjeans that this was so.

In a preliminary report published by the Portland Cement Association of America, the inspection team said that, "given the local building code, requirements, designs, practices and construction systems prevalent in Skopje, much of the serious damage could have been foreseen". In common with other

R.E.J.-L

post-war areas during a building boom, Skopje has suffered from a severe shortage of men capable of high standards of site supervision. In this respect Skopje was in a far worse position than most cities; in other European areas there is a tradition of building trades and men brought up in this tradition inherit new techniques and developments with little difficulty. In Yugoslavia, and especially in Macedonia, there is no such tradition and though designers and architects might fully understand the capabilities of new techniques and be competent in their utilizations, the practical aspects are little understood by the men on the site and their supervisors. There exists this enormous gap between the designer anxious to create a modern city with the modern techniques at his disposal and the contractor, working with, at best, semiskilled labour, and lacking the capital to buy large scale and modern plant and equipment. In Great Britain this problem has not existed in the last two hundred years, since the Industrial Revolution development in crafts and trades have progressed gradually with theoretical advancement.

A qualified artisan class does not appear overnight. The Skopje authorities are now considering the possibility of sending some of their young engineers to other European centres to study codes and practices. Evidence of the task that they will face was everywhere once the repair of damaged structures was undertaken in the city. Often large sums of money were spent in giving damaged buildings the appearance of strength without increasing their structural strength at all.

In masonry buildings wall panels that had shattered and collapsed were replaced with new panels of identical bricks and mortar as were originally used. As far as one saw these new panels were never tied in to the old structure in any way, often gaps under the next floor slab of up to 3-in were filled with mortar and the whole panel plastered over. Where reinforced columns had distorted in concrete frame buildings attempts had been made to repair the column by placing new reinforcement around the old column and then casting fresh concrete around it. The new reinforcement was rarely tied in to the level above or the floor below so that in the event of another tremor the columns would fail at exactly the same places as before, at the bottoms and the tops. In any event, pouring new concrete on to old concrete rarely produces an effective bond and failure and separation is likely to take place under stress.

Under the circumstances such mistakes were not surprising; a very small engineering community had been faced with a task of enormous magnitude, with little time and without the experience or equipment of modern techniques. It was better to do something than to do nothing. Unfortunately, what frequently resulted was a repair to the badly damaged section of a building that was grossly over strength in itself, but which would not, of itself, prevent the rest of the building collapsing in the event of another strong tremor. To prevent further expenditure on repairs of this kind the United Nations Technical Assistance Board commissioned two British engineers with experience in the structural strengthening of damaged buildings, to prepare a report. In work of this nature a great deal depends on the experience and common sense of the engineer supervising the repair; calculations of such a nature depend largely on the assumptions made, especially where original designs are not available, and the solution may bear little relation to the truth. For these reasons little has been published in this field and there were no references to which engineers in Skopje could go in search of an answer.

There are four types of construction that are in common use in the city. Adobe construction: This primitive form is most widely used in the Turkish quarter and in outlying areas. Basically it consists of timber frame which is then in-filled with bricks and mortar of poor quality. Many of these bricks are manufactured in the surrounding villages in clamp kilns fired by lignite or simply sun-baked. In such construction they are not normally load bearing which makes their quality of less importance.

Little loss of life occurred in these buildings for two reasons. Firstly they are never more than two stories high and less prone to the high compressive stresses set up by inertia forces when the building sways. Secondly, an inherent part of this type of construction is the provision of diagnonal crossmembers in the wall panels. Using the primitive tools and materials at their disposal it is not possible for the builders (frequently the prospective occupier) to construct stable wall panels of a large area. The cross-members reduce this area but at the same time, during the earth tremor, they acted as tension members, especially in the ground floor where they added rigidity to the entire structure. Because of this, though individual wall panels did collapse, the framed structure behaved well and did not collapse; most of the casualties being caused by failure of heavy tiled roofs. In some instances buildings of this type remained practically intact while neighbouring high-rise buildings suffered permanent distortion. In the weeks following the earthquake many such timber frames were refilled with salvaged bricks and the displaced occupants moved back in. It is interesting to speculate whether these members are not a traditional part of the design, earthquakes have several times hit Skopje and the provision of tension members may be a safeguard inserted "because they work". How much of this poorer area of the city will remain when the new Skopje is built is a matter for conjecture, it may be that this world perished with the earthquake.

The second form of construction in the city is the building of apartment blocks with load bearing brick walls supporting concrete floor slabs. These masonry walls were not reinforced in any way and were not tied in to the floor slabs. The buildings were designed for vertical loads only and had a maximum height in the city of five floors. The earthquake occurred at a time when residential buildings are most crowded and there were many buildings of this type in the Karpos area. In the building shown in Photo "5" 126 people are known to have lost their lives. The form of construction is readily seen in the surviving building of the pair which was of exactly similar design. Isolated failures of this type are only explicable in terms of bad building methods and poor site supervision; though in their report for the UN TAB Whitley-Moran and Long point out that it was frequently the east end of blocks that suffered most heavily and they suggest that in such cases most of the energy was absorbed by east end. In this case the collapsed building was the most easterly.

The series of photographs that follow show more clearly the mechanics of failure in masonry buildings. In Photo "6" the external walls have failed completely and the three upper floor slabs have collapsed on to one another. (Note: the reinforcement evident has been torn from these slabs.) In the upper part of the building what remains of the top slab is supported by a small part of an interior wall that has failed.

The next three photographs, Photos "7", "8", "9", all relate to the failure of the same building. Though it does not, at first sight, appear to have



Photo 4. The school at Karpos under construction. This school lay at the centre of the most heavily damaged residential area, none of the five storey blocks were inhabitable until early December.

# Earthquake relief work in Yugoslavia 4



Photo 5. A five storey masonry building that collapsed killing 126 people including a British engineer in the Karpos area.



Photo 6. The utter failure of masonry walls led to the collapse of many such buildings. The regular holes to the left of the ruin were made by rescue workers.

# Earthquake relief work in Yugoslavia 5 & 6



Photo 7. The collapse of the ground floor walls caused this building to "sit down". Note the planes of failure and the differences in height of the balconies to the right, east is to the left of the photograph.



Photo 8. The same building from the east, one complete block had already been cleared from the site.

Earthquake relief work in Yugoslavia 7 & 8


Photo g. A line of failure in the masonry at ground floor level in the same building.

suffered heavily a comparison of the balcony heights on the right reveal how much remains of the ground floor. At top right will be seen the mark left by the building in its original position. Note also the lines of failure in the face of the building. The house front lay almost exactly in an east-west direction (east being the left of the photograph) and in almost all cases failure lines ran from bottom east to top west, and always between points of structural weakness, ie windows, alcoves and verandahs and balconies. The damage to this building was typical of the whole city, it would have been far less damaged had it had a plain front. Careful examination reveals more conventional cracking in the centre where spalling has occurred. Here, though slight, the cracking is on both diagonals since the point is closer to the neutral axis of the building; it may have been caused by direct compressive stress when the building fell.

The mortar used in these buildings was lime mortar of very poor quality; the sand used was frequently dirty and the standard of workmanship was low. The permissible joint thickness was 2 cms, twice that allowed in Great Britain and rarely were cross-walls toothed into longitudinal walls so that the strength of the brickwork was greatly reduced.

The third type of construction is really a compromise form that uses reinforced floor slabs that are supported partially by masonry walls and partially by reinforced columns. In some cases the columns are discontinued after the second or third floor level. Many had open ground floors that were used as shop premises with apartments above. They normally went up to ten stories but not higher. Some, at the engineers discretion, had been designed to withstand wind loading of up to 20 lb/sq ft but none had been designed to take earthquake forces. In general they behaved well during the tremors and reacted as flexible structures suffering only slight damage. The heaviest

## Earthquake relief work in Yugoslavia 9



Sketch showing typical failure at ground and first floor levels. Several buildings of this type suffered severe and permanent displacement.

damage in this type frequently occurred at the stairwells which were of unreinforced, mass concrete and which absorbed much of the shock. Deformation of the ground floor pillars (see sketch) resulting from their rotation, left a permanent displacement of the building and was accompanied by severe spalling. Many of the columns had passed into the plastic stage; evidence of their reserve strength is that, though the city was subjected to very many severe tremors while they were in their damaged condition, no building using these columns fell.

The last type of construction were similar but used a concrete frame throughout and rose to to fifteen stories. Three such towers had been erected in the Karpos area and are illustrated on Photo "4". Each tower was built of a reinforced concrete frame with a mass concrete core that encased the two lift shafts. During the earthquake the buildings are reported to have swayed in an east-west direction but not so violently as to throw furniture about. Diagonal shear cracking occurred above doorways located in the core but, as would be expected, this decreased at higher levels.

In only one such frame was there structural failure, where the south-east column of one frame failed in compression. A core specimen from the column that was subsequently tested by the PCA team had a strength of only 2,250 lb/sq in instead of a design strength of 4,250 lb/sq in. The remaining two towers in the photograph experienced no serious damage. As in masonry structures the poor quality of the concrete contributed greatly to the damage suffered; failure always occurred around the aggregate indicating a weak mix and the aggregate was invariably rounded, having originally come from the river bed.

The Skopje disaster emphasised three things; firstly, the unsuitability of tall unreinforced masonry structures in seismic areas; secondly, the increase importance of using good quality materials in construction in such areas; and, thirdly, the need for a high standard of site supervision and control. The first is a matter of design and will undoubtedly be recognized in the planning of the new city; the second is largely a matter of economics and will place an increased demand on the already over-burdened construction programme; the third is a problem that will continue to face the engineers of the city throughout the unprecedented building activity they will be undertaking during the next decade. Nevertheless, it is only by constant attention to these problems that Skopje can be assured that there will be no repetition of the disaster of 26 July 1963.

(Note by Editor. Lieutenant C. G. B. Brodley was awarded the MBE for his work at Skopje, Staff Sergeant Richardson was awarded the BEM; Corporal (now Sergeant) Pettyman and Corporal Peters received the Commander-in-Chief's commendation.)

# The Brunei Works Section— Royal Engineers, 1 January - 1 March, 1963

### By MAJOR K. DONALDSON, AMICE, RE

### INTRODUCTION

DURING the early part of December 1962 there was a rebellion in Brunei. Led by Azahari, this "popular uprising" against the Sultan of the largest oilproducing State in the Far East was almost successful. The Sultan of Brunei appealed to the British Government for aid in accordance with an existing Treaty. In response to this appeal, units of 17 Gurkha Division were sent to Brunei from Malaya. Acting with great speed and military skill, these units soon captured most of the rebels and dominated the principal towns of Brunei, Seria, and Kuala Belait.

An Emergency Executive Council was formed for the State of Brunei. One of its tasks was to resuscitate an almost paralyzed administration and, as a priority measure, get relief and development projects under way.

By Christmas 1962 the Brunei Public Works Department was completely disorganized and its whole effectiveness brought to nil. The PWD had begun to falter before the revolt due to changes in the executive appointments. Other contributory factors were the interference in engineering matters by administrators and political pressure on staff and workmen. When the rebellion started approximately half the workmen joined the rebels, some of the Technical Assistants were on well-timed long leave, others just stopped working.

During the first week of January 1963, the newly raised Works Section arrived in Brunei. The units of COMBRITBOR were deployed in Labuan, Brunei, and Sarawak. Units and formation HQs were based in operational camps and schools, except in Seria where the Battalion lived in Shell Company bungalows. In Labuan the BAA units were under canvas. In the PWD the position was serious. Many workmen were in detention, there were no effective engineers. The staff that remained was disorganized and understandably apathetic. The PWD Offices were in chaos after being "occupied" by a military unit. Fortunately the power station and filtration plant were working as was the sewage system (mainly large individual septic tanks). Another asset was the existence of several Chinese building and civil engineering contractors ready to start work—and make money.

#### ORGANIZATION

The aim given to me by Brigadier J. H. S. Bowring, CE FARELF, was simplicity itself. "Go to Brunei and get the PWD working again." The Works Section was formed quickly. The establishment is shown at Appendix "A". The staff was recruited at very short notice from FARELF mainly from ESSE. Most of us left our normal jobs within twenty-four hours of being called for just before New Year's eve. Captain K. E. Crossman, AMICE, RE, wrote an equipment table in three hours. We drew the equipment but did not use it because the Brunei PWD was superbly equipped.



Photo 1. An aerial view of Brunei Town and Kampong Ayer. ("s" indicates school used by unit of Com Brit Bor)

# The Brunei Works section, RE 1 January- 1 march 1963 1

On arrival in Brunei the Deputy High Commissioner, Mr P. H. Meadows, CBE, MC, briefed me on the current situation and instructed me to act as State Engineer working directly to him and the Emergency Executive Council. I decided that the best way to achieve the aim was to do all work, civil and military, using PWD resources. To supervise the work of the various departments, I started a planning and control office consisting of Captain K. E. Crossman, RE, and the Senior Clerk of Works (Constr). The appropriate type of Clerk of Works was placed in each department.

#### TASKS

There were four types of work to be done :---

(a) Emergency works, eg building detention centres for prisoners.

(b) Military works, eg planning a new battalion camp, etc, for the Gurkha Battalion.

(c) PWD works, eg normal road repairs, maintenance of Government quarters, etc.

(d) Long term civil projects, eg new roads, a new military barracks, etc.

Initially the emphasis had to be on the first two items because of operational requirements. After getting the PWD system working again, more and more time had to be devoted to planning and constructing service works. These works were not only connected with making living more comfortable, but embraced such things as a helicopter hangar, a complete airfield complex at Brunei Airport consisting of offices, transit camp, aircraft repair facilities, etc.

The four main schools in Brunei town were used by the Force which left some 4,000 school-children without lessons and idle in their homes. We prepared a phased programme for the rapid production of elassrooms on various sites throughout Brunei. As a first phase of this programme, using prefabricated steel-frame structures brought in specially from Singapore, we were able to build a complete fifty class room school in eight weeks. A major problem was the collection and repair of all the desks, chairs and school equipment which had been left out in the torrential rains. A corporal carpenter (assistant C of W (C)) handled this problem in true Sapper fashion. He collected all the battered desks from the scattered sites and arranged a repair programme in the PWD carpenter's shop. In three weeks over 1,000 pieces of school furniture had been re-built or repaired. A remarkable achievement considering that this was far more work than had been done in the workshop in the preceding six months. Furthermore he did not speak a word of Malay or Chinese.

During the first two weeks of January Brunei and Sarawak experienced some of the worst storms and highest rainfall ever recorded. Part of the Force had to be deployed on flood relief operations. In Brunei town there were serious land-slips and foundation failures. The newly constructed detention centre was 1 ft 6 in under water. A new one had to be hastily improvised in an almost completed private Chinese school.

The major crisis was the fracture of two 12-in cast iron pipes linking the water storage tank, the filtration plant and the wash tanks at the Brunei Town water works. The huge Braithwaite water storage tank was at the top of a steep hill, the pumps and filtration plant at the bottom. Linking the two was a 12-in pipe laid under ground. The wash tank main ran supported overground on concrete pedestals. Due to the heavy rain the whole tank and pipe system began to move gradually towards the filtration plant. In spite of the various remedial works we carried out, the pipes developed a dangerous looking curve before they finally fractured at 7 o'clock on a grey, wet, miserable morning. Brunei Town was now without treated water. Fortunately an untiring Clerk of Works (M) had managed to trace an old pipe system which fed direct from the reservoir, and could be fed into the town main but not into the filtration plant. After informing everyone that the water had to be boiled before drinking, the rusty old stop-cock was opened and the town had water again for at least two hours a day. The system was finally repaired with pipes and specials bought from Shell in Seria.

There were some important considerations in my selection and commencement of long term civil projects. These considerations were the need to give the existing staff something interesting to take their minds off their troubles, and to get the system going so that newly recruited staff (from the Philipines!) could be absorbed into a Department that was functioning. A road project was started, this not only employed some of the vast amount of earth moving plant lying idle, but also aided rural development and helped to abate some of the discontent of the Kampong people. Another project started was a block of flats. This was to provide accommodation for newly recruited staff in the Government Service. In each case arrangements had to be made for land acquisition, the allocation of State funds and the organization of the work.

The Works Section also dealt with works for the Royal Navy, the Army, and RAF in Brunei, Sarawak, and Labuan (until 11 February 1963). This led to some problems particularly in Labuan. See Appendix "B" describing these problems which placed a heavy load on the Works Section at its busiest period.

#### FINANCE

Dealing with Brunei only, it must be said that the allocation of funds to projects did not present any real problem until early March 1963. Then there was a slowing down in the allocation of money from Brunei funds for service works. This lack of financial restriction was a terribly important factor. It meant that if something was necessary or worthwhile one got on with it. An unusual circumstance for a military engineer! The main reasons for this happy financial climate were due to:—

(a) Brunei being a very wealthy State from its oil revenue. (My official car was a brand new Austin 110 Westminster; the American Plymouth was unsuitable because parking space was limited at the rear of HQ COMBRITBOR!)

(b) The system of prior agreement for projects in the various committees, such as DEC (District Emergency Committee) and BOC (Borneo Operations Committee).

(c) The speedy tender and acceptance procedure developed by the Works Section for all contracts. There were two aspects of this, one was the physical drill of tendering and acceptance which is outlined in Appendix "C". The other aspect, perhaps more important, was the liaison between the Mentri Besar (similar to a Prime Minister) the Deputy High Commissioner, and the DCRE where PWD affairs were concerned. It was this liaison which freed money quickly whereas before it had sometimes taken from three to six months for a similar allocation of funds. The total value of all types of work started and under planning up to 1 March 1963 was £432,000. This figure gives an indication of the financial volume of work in a fairly busy two months. Of the figure of £432,000, approximately £87,000 was either completed or at the final bill stage.

### COMMENT

The activities of the Brunei Works Section RE in support of the Force on Brunei operations shows clearly the need for:—

(a) A reserve of Works Services trained officers and senior NCOs. It would have been impossible to re-activate the PWD and do works services for the Force quickly, if ESSE (Engineer Services Special Establishment) personnel had not been sent to Brunei. This is the main comment. The time taken by the RAF to get a works unit in Labuan, ie aproximately five weeks, emphasizes the requirement of a suitable reserve.

(b) A set of standard accommodation drawings, similar to those for the Australian pattern hutting, with a list of stores and specification printed on the same drawing. This facilitates speedy contract action and construction.

(c) A common quartering policy for a joint force and staff action to implement the policy.

Amplifying the point about training in the previous paragraph it should be noted that both the DCRE and GE had completed the Long Engineering Course. The main value of this course, as applied to Brunei, was the training of an *all round* engineer with a good knowledge of civilian methods and techniques. As a DCRE dealing with civil projects I found this training of immense value, especially in the presentation of engineering ideas in a way which was acceptable to civilians. An ESSE attachment after the course has been very useful.

Considering the training of the senior NCOs, ie the Clerks of Works. The main qualities required were those of a good Sapper senior NCO plus ability as a Clerk of Works, with special emphasis on proficiency in draughtsmanship, quick estimating, and organization of work. Fortunately we had a splendid selection of Clerks of Works. Their prime asset was their soldierly qualities. In fact all the NCOs were extremely proficient technically. I am sure that any success the Works Section may have had, was due to those qualities which a unit is proud to have in its NCOs.



Photo 2. An aerial view of Seria Town and the Brunei Shell Company's industrial complex. A source of wealth. (The Shell company were prepared to loan us the accommodation in Area A for development as a military camp)

The Brunei Works section, RE 1 January- 1 march 1963 2

### APPENDIX "A"

### WORKS SECTION RE

# Employment: With COMBRITBOR Brunei

		(1) Perso	onnel					
Detail	Offi- cers	WOs Class I or II	S/ Sgts	Sgts	Cpls	L/ Cpls	Sap- pers	Total
Deputy Commander, RE (Major) Garrison Engineers:	I							t
Assistant Clerks of Works (Construction) Clerks RF	I			I	2		1	3
Drivers Sapper for duty as batman			-				2 1	2
Total all ranks	2			1	2		4	9
Engineer Services Special Est (ESSE) Clerks of Works (Constr) Clerks of Works (Mech) Clerk RE (To have works/ resources experience) Engineer Draughtsmap (C & S)		ĩ	2		I			3 1
		l				i		
Total ESSE		2	2		1	I		6
Total, Works Section, RE	2	2	2	I	3	I	4	15

(ii) Transport Motor Cycles

Trucks  $\frac{1}{4}$  T<sub>4</sub>  $\times$  4 2 + trls.

2

Author's Notes

1. The balance between Construction and M & E was about right.

2. There is no adm backing. The Section is therefore dependent on another Unit for living, pay, etc.

3. Who now trains RE Corporal Clerks in financial matters, such as keeping Construction Accounts?

### APPENDIX "B"

WORKS SERVICES PROBLEMS IN LABUAN

1. Labuan is an island in North Borneo, ie a different government from Brunei, with an RAF base near the commercial airfield. There was a small RAF works office capable of doing minor maintenance for approximately six RAF buildings. The land is 98 ft above MSL with a high water table; very little land is owned by the Government and it is difficult to find suitable camp sites on that land which is owned. The main factor affecting the entire scope of works planning was the lack of a firm decision on the question of the use of Labuan as the main base for Borneo operations. In fact, no firm "Q" brief. In addition the RAF required different scales of accommodation. In particular they required septic tank sewage disposal which increases costs greatly. There was also a difference of medical opinion on the use of septic tanks, bucket latrines or deep trench latrines. Since Labuan was not involved directly with the revolt in Brunei there was the problem of paying for any accommodation built for the Force. Until financial approval was given work could not start. 2. The final problem was the work load on the Brunei Works Section which meant that a WO I Clerk of Works had to arrange for the "Get-You-In" Works Service for BAA units in Labuan and his normal works in Brunei. This Clerk of Works could not be based permanently in Labuan, which meant timeconsuming travel in boats and much hanging around airfields waiting for an infrequent air-lift. The "Get-You-In" jobs were not extensive in themselves, but they were bedevilled by flooding and a marked reluctance by units to make themselves comfortable!

3. When the decision that the RAF would assume responsibility for works in Labuan was made in the last week of January 1963, there was an RAF Staff Officer (Works) at COMBRITBOR. It was therefore agreed that RE assistance would be given to this RAF officer to plan the accommodation required in Labuan. Finally, nine sheets of drawings plus estimates were handed to an AMWD representative on 11 February 1963. An RAF works unit did not arrive in Labuan until 27 February 1963, some five weeks after the decision that the RAF were responsible for works.

### APPENDIX "C"

### SPECIAL WORKS CONTRACT PROCEDURE

The following system was used for getting works (civil and military) done by contract:---

1. A comprehensive set of drawings was produced. There were several PWD draughtsmen left in a lavishly equipped drawing office; all the Clerks of Works were excellent draughtsmen.

2. A detailed description of the works was written, this, together with the drawings and the PWD standard contract documents, formed the basis of the tender. For larger works, a schedule of rates was included in the tender documents.

3. A quick estimate of the cost for doing the work was prepared.

4. The appropriate class of contractors (either class "A", "B", or "C" depending on the estimate) were called to the office and invited to tender. The time for the return of tenders was generally twenty-four hours; on a big job, say £15,000, two to three days were allowed. It was stressed that no late tenders would be allowed.

5. The tenders were scheduled by the GE and appropriate Clerk of Works. The DCRE recommended the acceptance of the lowest sensible tender and asked the Deputy State Engineer to concur. The schedule of tenders was taken to the Mentri Besar's office where it was quickly approved.

6. The selected contractor then signed the PWD Standard Contract and started work. Most jobs were to be completed in very quick time so the amount of liquidated damages was increased to three times the normal rate in Brunei.

7. Having got the contractor working, the next stage in the procedure was to get the funds warranted before the first claim for payment appeared. Contractors were told that interim payments would not normally be made, but that the final bills would be paid promptly.

Note.—The mainstay of this procedure, as far as the production of a set of contract documents was concerned, was speedy, accurate draughtsmanship and estimating. This procedure would have been useless had Clerks of Works not been well trained before arriving in Brunei. It was too late to start then!

# Man Management

By CAPTAIN T. B. MCMULLEN, RE(TA) (131 Parachute Engineer Regiment (TA))

During the winter 1963-64, Headquarters, 27 Engineer Group (TA) ran two weekend indoor exercises for young officers of the Reserve Army in Eastern Command. With the ending of National Service an increasing number of officers are joining the Reserve Army direct without previous training and experience acquired in full-time service. For the benefit of such officers, these two exercises covered a wide range of subjects of importance to troop commanders. One of the principal contributions dealt with man management, including the lecture on which this article is based.

#### INTRODUCTION

GOOD man management is a matter that we all find fascinating, but surprisingly elusive, and yet we know that it is of fundamental importance to every officer and NCO to try and master it. The importance lies in the fact that it is good man management that binds officers, NCOs, and soldiers together into an efficient, high-spirited, and effective unit. It is like the mortar that binds bricks together into a wall, and the strength of that wall depends not on the bricks themselves (there is no weakness there usually) but on the composition of the stuff that holds them together.

Man management is not in any way an easy subject to study for three reasons:-

First, because every man under our command is an individual, and different in countless respects even from the men who parade to his left and right. Men are not machines with a predictable performance, nor do they easily fall into straightforward groups or categories for which standard handling techniques can be devised, so that what might well be an excellent way of dealing with Spr X is disastrous to Spr Y.

Secondly, man management is a hard subject because every officer and NCO is himself different in personality and in temperament and in ability, and so it is just not possible to legislate on how one should deal with a given soldier in a particular instance. One officer may feel that a few quiet wellchosen words with the soldier is the correct treatment, whereas another would blast off a three-stage rocket to the same man. Both could be right, and as effective.

The third difficulty in coming to grips with this subject arises from the first two. Because both men and officers are so diverse in nature, the subject is inevitably diffuse and capable of discussion only in the broadest terms; consequently, very little has been written or filmed that will help the would-be student to get his mind attuned to the subject. There is no pamphlet entitled "The Management of Men" although one can find pamphlets on the management of everything else from mules to missiles. The only available film on the subject, which is entitled Officers and Men, although looking promising in the catalogue, turns out to be made in 1944 and the general tone is so antiquated that it is laughable nowadays.

Perhaps, after reading this depressing introduction, a young officer may be tempted to feel that man management is an impossible subject to master, but let me say straight away that there are a number of general principles which are useful guides for thinking out the subject, and I intend that we should examine these further. But first, let us pause and consider what it is we are aiming at in good man management—what is its purpose?

#### PURPOSE

I would suggest that the object of man management is this: "To produce and maintain a team of soldiers who will work and fight perfectly under your leadership, each of them possessing the highest individual morale." Notice that such a team needs to be produced first of all, and then it needs to be maintained, because the members of it will come and go, and the situation and conditions are constantly changing. Notice too, what the aim is not. It is not the object of man management to set up and operate as a sort of military citizen's advice bureau to sort out soldiers difficulties at home. Nor is it the aim simply to produce smart well-fed, well-paid and contented soldiers who keep out of trouble. These are admirable by-products of good man management and help to produce high morale, but the supreme aim is to produce a perfect working and fighting team-the mission or task must always come first. In the Territorial Army in peace time, I think we are particularly prone to losing sight of this objective because we are men of divided loyalties, and even the completion of the mission has to take second place to the demands of our civilian employees, and of course, one can rarely field the same team two weeks running so that the building up of a good troop is a frustrating task. However, let us think about this subject in the framework of a rather more straightforward situation. Let us imagine that the great moment has come, that we have been mobilized, and that we have been appointed as a troop commander of a field troop, which we proudly call "our" troop.

Having paused to examine the purpose, let us turn and look at some of those broad guiding principles.

#### PRINCIPLES

If I asked you to write down on paper what you consider to be the seven most important principles involved in man management, it would be interesting to see if we agreed on any of them!

However, here are my seven. It is not an exhaustive list, some of them are painfully obvious, but all of them are important.

Know your men. There are two stages involved here, first knowing about one's men, and then getting to know them personally.

Firstly, knowing about them. On joining a new troop, this would mean of course knowing their names, matching these with their faces, knowing also their backgrounds, their army career to date, their outside interests and so on. Fifty life histories are not going to be an easy thing to grasp in a hurry, but the speed and accuracy with which you master all this will immediately reveal your interest and concern for them as individuals.

I suggest that one uses a confidential notebook for this purpose, into which one puts all the relevant facts about each man, and to which one adds from time to time one's impressions of him, his achievements, troubles and the like. Such a document is an immensely valuable record of each of the men, and also is most helpful when one has to write reports or consider promotions. It is also an enormous asset for one's successor, but it does need very regular entering-up.

Secondly, getting to know them personally. This, of course, will happen

naturally as time passes, but the speed will vary very much from officer to officer. We will get to know them as individuals by working and training with them, by giving them lectures and having discussions afterwards, by playing games with them, and by visiting them in their lines informally. In each of these we have to maintain that difficult balance between friendliness and familiarity. As we do these things with them and get to know them, they too will be getting to know us.

Set a first-rate example to them. If one has got pips on one's shoulder, one is on a pedestal, whether one likes it or not, and the NCOs and men watch us very closely and take a lead from us. Therefore it is vital that our behaviour, our bearing and all that we do is first class.

Take, for example, smartness. Unless our turnout, haircut, and drill are first class, we cannot possibly correct a man on parade in any of these matters. One would be a gross hypocrite. I was once much impressed when talking to a major who was about to go and take a parade—I complimented him on the high standard of his turnout and he said to me, "I would not dare go on parade unless I was the smartest man there", and this seemed to me an admirable attitude.

Then take punctuality. If one is late for parade, every man there registers the fact and one cannot possibly insist on one's NCOs arriving on time for duties and periods. And what about the works tickets? If one doesn't use them, or misuses them, one is in no position to deal with a lazy or dishonest driver in the troop.

Then lectures—if one doesn't prepare ones lectures and consequently gives poor ones how can one ever help or criticise one's NCOs when they lecture? And so one could go on.

However, the British soldier is remarkably generous in his demands of officers. He doesn't expect perfection, and he tolerates occasional nonsenses good-humouredly, but he hates sham or hypocrisy or double talk or double standards in any form.

It seems to me that setting a first class example is a matter in which a committed Christian officer is at an advantage; not, of course, that he is any better than his Godless colleague, but he has a strong underlying motive in all that he does—namely to please his master, and he has unlimited resources at his disposal with which to produce the highest standard.

Demand high standards from them. If one sets a high standard oneself, one is in a position to demand a high standard from one's men. If one doesn't, one can't and one's team is of poor quality. I am thinking now, not just of turnout, drill, punctuality and works tickets, but more widely; that a philosophy of "doing the job really well and thoroughly" is one that pays good dividends in the long run. For example, take shooting. We all know how casy it is to go to the ranges and dash through a number of abbreviated practices in order to get the men off by midday (you know, full battle order meaning beret, borrowed haversack and one empty waterbottle between three!) and follow this by a pretty cursory inspection of arms and omit the no live ammunition declaration. One may get one's men off by midday, but what sort of marksmen is one producing, and how confident will one feel about the strength of one's unit when it comes to the real point?

If one does insist on a high standard—on doing the thing properly, one usually gets two reactions:—

A good deal of unpopularity and binding at the time, although this

usually turns to respect, providing, of course, one ensures that one is not simply being officious, or trivial, but is striving solely for efficiency and the good of the troop, and secondly:

The morale and self-confidence of the soldier rises, because he sees he is getting somewhere, he is becoming more skilful, and he begins to take a pride in the job. And of course, once this attitude germinates, one is halfway to achieving one's object in man management.

Keep them fully informed. Another striking characteristic of the British soldier is that he will work like a horse if he knows why he is doing it. Therefore, it is of the utmost importance as far as possible to give him reasons for what we tell him to do, and let him see just how his job fits into the overall operation. This is not always possible because the situation may be so crucial that there is no time for anything but curt orders demanding blind obedience, or perhaps security does not allow one to give all the explanation one would like. Field-Marshal Montgomery's principle is a good one, "I could not always tell them the whole truth, but what I did tell them was always true, and they knew it, and that produced a mutual confidence between us". For example, if on an exercise, one finds oneself waiting interminably in a harbour area for something to happen, tell the troop what the delay is and what the stand-by time is. For if they know the cause of the delay, or at least what sort of notice they can expect before moving, they will be quite happy. But if no one knows what is happening and the troop is standing by expecting to move at a moment's notice, it gets fed up and loses heart, so that when a move does come, it's not a good one. If you don't know what the delay is, then this fourth principle has been violated further up the chain, and it's up to you to find out from your OC what's up.

One trap is easy to fall into, and with the best of intentions. It is the making of optimistic promises in order to raise morale. You know the sort of thing, you're near the end of a night march, and not at all sure which grid square (or perhaps even, which map sheet) you're on, but you think you can't be far off the RV and you are conscious that your men are grinding a bit, and so you go along and say to them "Cheer up, chaps, you'll be in your sleeping bags before the hour's up" in the hopes of encouraging them, but after the third, fourth, and fifth hour with no sign of the RV, they have not only lost all the skin off their heels, but they have also lost confidence in you, or me, because we didn't fulfil our promise. If promises are made, they must be kept, and if the prospect ahead does look bleak, it's better to tell them so, and do so humourously if you are made that way. If you should make up a bit of time, or the going improves, they will be thoroughly satisfied and you haven't let them down, although you might feel that a little map-reading practice would do you no harm.

Do all you can for their comfort and welfare. Soldiering is often a rough, uncomfortable and unpleasant business, but no good soldier minds putting up with extreme conditions, if he is convinced that they are the best available. What does gall him, though, is the suspicion that conditions could be a lot better for him if the management, that is you or me, took more interest over his creature comforts and spent less time and trouble on its own.

Now there is a great deal that one can do and one must do, for one's men if one is looking after them properly—but its important too to maintain a sense of balance between mollycoddling them on the one hand and neglecting them on the other. On taking over a troop, some of the things one would want to look into would be these:—

The state of messing to see that the cooks' conditions were tolerable and that the best use was being made of the rations and local produce available; that NAAFI supplies were working properly.

The mail—that collections and delivery were efficient—nothing worse for a soldier than being out of touch with home.

That available *entertainment*, in the way of cinemas, concerts and the like was being exploited.

That recreation was available of the sort that the men appreciate.

That *pay* was being handled properly and that grievances and problems got sorted promptly.

That *leave* was organized fairly and that the maximum entitlement was granted.

That the troop knew about the various welfare services that were available. It is very likely that in a troop of fifty, there would be at least one or two with home difficulties, and these organizations are immensely willing to help wherever they can.

That the *Padre* and *MO* paid regular visits and that there was a chance for the men to consult them on particular problems.

And so one could go on—there is an unlimited amount that one can do, if one is really taking seriously the business of looking after one's men. As they see us taking pains on their behalf, an unshakable relationship will build up between them and us.

Decentralise. If one is out to make a success of one's troop, it is very casy to fall into the attitude that one must be everywhere all the time directly supervising all that's done. But this is erroneous, and it is also very proud. There is already built into the troop composition a very adequate chain of command, and an officer who makes little use of this cannot call his troop an effective team, because few of the heavyweights are being allowed to do their job. There are a number of reasons for decentralizing, and the more obvious are these:—

Unless an officer decentralizes, he is putting his NCOs out of a job. He must not do this even if they are bad NCOs—they have got to learn. Furthermore if he does by-pass the chain of command and issues orders direct to the soldiers, he is liable to find his orders conflicting with his NCOs and his NCOs do not know what is going on.

An officer needs lots of time for cool, sober, thinking. He cannot begin to plan efficiently or to devise new and interesting methods of training, or to think about his men's welfare, if he is bogged down by a weight of detail and administration that should be undertaken by his subordinates.

NCOs generally thrive and mature militarily when given genuine responsibility. The more one can give them this, the better one is preparing for the situation that may well occur in war when the troop loses its officer and the NCOs have to carry on alone.

For most troop commanders this principle is the hardest of all to learn. They know their men—often too well, they can be made to set and demand a high standard, they can be taught how to keep their men well informed, and even persuaded how to care for them though it riles them, but they find it extremely hard to decentralize—they won't stand back from the aerial ropeway, or whatever it is they are making, and let the junior NCOs do their jobs. In their enthusiasm, they love to get embroiled, then who is there to keep an overall eye on safety, or anticipate the snags or co-ordinate the various sections?

Select men very carefully. As a troop commander, one is not infrequently faced with this sort of question, "I have got to send one of my sections off on their own for three days, which one am I going to send?"; "Sapper Snodgrass has applied for the plant course—is he the best one to go?"; or this, "Two of my Lance Corporals are being posted away shortly, who am I going to promote from the troop to fill their place?"

Now the solution one gives to questions such as these are going to affect one's whole troop to a surprising extent. Ideally, one would hope that all sections in one's troop could tackle all jobs equally well, but because of the human element, the sections develop different characteristics—one may become expert at night work, while another is always slow in getting trenches dug. So one section is often better suited for a particular task than the rest. Now I am not going to pretend that the selection of sections at troop level is usually a hard thing—the decision is generally pretty straightforward, but one can see that this decision becomes harder for more senior officers.

For a troop commander, selection is usually choosing men for individual jobs or promotion. The wise officer will give each case extremely careful thought, weighing up all the pros and cons, for decisions of this sort are invariably irreversible. Once you have made a man a lance corporal, you can only reduce him for disciplinary reasons or because he is utterly inefficient. There are two aids that one can use:—

A confidential notebook—the one I mentioned under my first principle, which may well help to give a more balanced picture of the men concerned if it has been conscientiously compiled.

The advice of one's troop sergeant—this will depend on how well one knows him. But this should be especially valuable because he knows much more what the men think of each other, if you are considering a promotion, and he usually has a pretty shrewd sense of judgement anyway. But he is not always right, and one does not have to take his advice.

This principle is often neglected, but is an important one. It is of interest to note Field-Marshal Montgomery's views on this subject—he wrote that he spent about one third of his working hours considering personalities.

Here then, are my suggested basic principles, and it seems to me that these, suitably mixed in with liberal supplies of common sense and good humour, will make an excellent mortar which will bind a troop commander, his senior and junior NCOs, his sappers and his cook into a rock-like team which can do a really worthwhile job in its unit.

#### CONCLUSION

To conclude, I would like to remind you once again of the purpose that we are aiming to achieve in good man management. It is to produce an effective, working and fighting team in which each member is operating in top gear militarily, physically, mentally, and spiritually.

I then suggested a number of basic principles for achieving this purpose. It was not, of course, an exhaustive list, though I believe each of the principles mentioned is relevant.

It has been said that good man management is an Art which must be developed—it is not a Science that can be learnt from a book. I would like to add, nor can it be learnt from a lecture, but it can be learnt the hard way by doing it.

# Lundy Island Project

By CAPTAIN J. M. REX, RE (TA)

BEFORE 115 Corps Engineer Regiment (TA) went to camp at Fremington, North Devon, in 1964, permission was sought and obtained from the owner of Lundy Island to carry out military training and Sapper tasks. Permission was readily given by the owner, Mr A. P. Harman, himself a war-time Sapper, and a few months before camp, administrative arrangements were put in hand.

The regiment has specialized in island working, and only two camps previously had spent a fortnight in Alderney, therefore Lundy was something to look forward to as another very interesting place in which to work.

Problems of accommodation, transport and feeding had to be resolved. The first two were quickly overcome, thanks to the hospitality of the owner who gave the regiment the use of an old light-house for a base depot. The island boat, the MV *Lundy Gannet*, which plys between Bideford and the island twice a week, was also used to transport the men, their equipment and stores.

However, that small stretch of water between the North Devon coast and the island—23 miles away—can be notoriously rough and some alternative arrangements were necessary. 848 Naval Air Squadron from Culdrose in Cornwall were most co-operative in giving air lifts to the regiment, and troops and stores were ferried back and forth in Wessex Whirlwind 5 helicopters.

About six weeks before the start of camp a recce was made by the Group Commander, 26 Engineer Group, Colonel Robin Parker, the Commanding Officer, 115 Corps Engineer Regiment, Lieut Colonel H. Benson Ansell, and the Training Major, A. I. Braithwaite. They went to decide the most suitable type of training that could be carried out.

Because of the absence of transport (there are only two tractors on the island) as the island is a virtual bird sanctuary and reserve for wild life, and because for the most part Lundy as a 500 ft high block of granite with sheer rock faces around most of its perimeter, it was decided that the best type of training would be found in the area of the landing beach.

Several parts of the rock face at the landing beach were found to be badly undermined by surface water percolating through the top soil, reaching the clay sub-strata and then without penetrating further, working its way down from the high ground until it reached the rock out-crop where it infiltrated between exposed parts of the rock. The rock is highly stratified around the landing beach and geologically is much weaker than most of the rock in other parts of the island. The dip is very steep and the downward percolation of water, combined with the natural processes of erosion at the foreshore, had badly undermined the winding track cut into the rock slope leading from the beach to the island's hotel. Fortunately most of the undermining of the road was confined to several small sections over a length of 100 yds.

It was, therefore, decided to give some practical training to the regiment's construction tradesmen and sea defence works became the order of the day. Exercise "Puffin Stuffin" became a reality!

The initial assault force consisting of one officer, one senior NCO and ten men, set out by sea at dawn on 19 June but like their more famous predecessors, found "D" Day delayed for 24 hours (twice) by unfavourable weather but eventually landed on 21 June to set out the task. The main party of the regiment had now arrived in Fremington Camp and an additional party of six men joined by helicopter on 22 June. The CO checked progress by the same flight and decided to send six further re-enforcements by sea on 27 June.

The whole task was divided into four separate sections. Three sections consisted of constructing sandbag walls at beach level to form a shutter to retain the concrete, and once the necessary preparatory work had been done it merely became a question of pouring mass concrete;  $2 \times 3\frac{1}{2}$  cu-ft concrete mixers were set up on the road immediately above the work at beach level; aggregate was collected continuously from the beach in sandbags and transported to the mixer site by tractor and trailer, and a corrugated iron shute to carry the concrete was constructed from the road down to the beach. It was found that the key to the whole job resolved itself into two distinct operations. One, the continuous winning of aggregate from the beach, and the combined output of the two mixers; 300 cu yds of concrete was only on the island for eleven days, long hours had to be worked and Saturdays and Sundays were not excluded.

The aggregate found on the beach was perfectly graded in its natural state; it was smooth, flat and fairly strong. The water used for concreting was taken from the sea; the saline content was remarkably low, but as the islanders had done work of this nature themselves without any special precautions, it was decided not to use any counter measures in the concreting. A particularly bad section where the cliff had fallen away from beneath the road obviously had to be tackled, and it was at this point that a novel feature of the work was introduced. Without a tremendous amount of preparation, access from the beach to this part of the work would have been difficult, and it was, therefore, decided to plant a block of concrete  $10 \times 10 \times 2$  ft thick on the cliff face. For this work it was necessary to rig working cradles suspended from ropes anchored back to a position on the side of the road remote from the cliff. Working from these cradles, holes were drilled into the rock face for 1-in diameter steel rods which were grouted in and left protruding; on these rods were suspended two sheets of BRC fabric and when this preparatory work was finished, a complete formwork to contain the concrete was also suspended by steel wire rope anchored back to pickets fixed in the ground at the back of the road. It was agreed with the owner to leave this formwork in position until he could arrange for the islanders to work from the beach upwards to meet this suspended "piece of concrete".

The weather held fine on 1 July and 848 Squadron worked overtime to withdraw all troops and stores to the mainland, where the RSM soon had those beards off.

Although the hours worked were long and arduous, the hospitality of the islanders made up for all the energy expended and many kindnesses were shown to the troops. Fresh vegetables and bread were freely given to supplement compo rations; a mid-week cricket match was arranged, and Mr Harman, the owner, also arranged a two-hour boat trip around the island one evening. In addition to this one member of the troop celebrated his birthday on the island and a combined party of islanders and soldiers was held in the island's hotel one evening, music being provided by the guitars of some Austrian ski instructors working on Lundy during their close season.

# Correspondence

Military Engineering Experimental Establishment, Christchurch, Hampshire. \_ 22 July 1964

The Editor, RE Journal.

# REPAIR OF LIGHT ALLOY BRIDGING EQUIPMENT

Dear Sir,

Colonel Lawrie's useful article on the Repair of Light Alloy Bridging Equipment, in the June issue of the *Journal*, has given rise to much discussion within MEXE. In commenting on some points of discussion below, I should stress that opinions expressed are my own or those of colleagues at MEXE, and are not in any way an official comment on the article. The headings below are those used in the article.

Proposed Organization. In considering a possible organization, the query is posed "Should we go for riveted or bolted patches, or welding or both?" The author considered welding the most advantageous for various reasons given in the article. I do not agree that welding is necessarily the best method of repair in all cases. The simplicity and case of self tapping screw patches and epoxy dough patches should not be overlooked; indeed the welding of a patch in the centre of a large plate is a most difficult task, because of shrinkage movements which develop, with consequent tendency to hot cracking. In the case of struts, bolting and riveting may well be the only method of repair that can achieve 100 per cent strength. In short any repair organization must be based upon a balanced range of available repair processes, the most satisfactory process being selected for any particular repair.

Training Policy. The philosophy of developing skilled welders is fully supported but we must not expect too much from such skilled labour. Such skills are essential but they require the backing of professional knowledge, both metallurgical and engineering, on the part of the officers and senior NCOs. It is not agreed that this kind of knowledge is at present practised in civilian firms at shop floor level.

The authors remarks regarding the necessity to train units to use and treat equipment intelligently is strongly endorsed. The trend towards airportability in equipments means that robustness and "Sapper-proofing" must to some extent be sacrificed for the sake of lightness. Unless units will respond whole-heartedly and treat new equipments being developed with due care and respect, the maintenance load on these equipments is bound to be high.

Limitations and Advantages of Aluminium Alloys. Although the electro-chemical series quoted by the author is theoretically correct, it can be most misleading for practical purposes, because it neglects to take into account the oxide film that forms on many metals. This film is significant and in many cases reverses the order of metals in the table. In fact, each couple must be considered individually, bearing in mind the solution in which it is immersed. A good guide to the corrosive reaction between any two particular metals is given in the Inter-Services Metallurgical Research Council publication "Corrosion and its prevention at Bimetallic Contacts".

Properties of Different Alloys. Although Fig. 2 is undoubtedly correct for a particular circumstance, it paints the picture a little too black for general application. The width of the heat affected zone depends upon many factors, including the type of alloy,

the type of welding process, speed of welding, the mass of the structure being welded, which affects the cooling rate, and, if the alloy is natural ageing, the length of the ageing period. In some cases the width of the heat affected zone can be less than  $\frac{1}{2}$  in each side of the weld.

Table I. Although the author suggests that the Medium Girder Bridge and the Class 16 Airportable Bridge will be made of Impalco 720 and Hiduminium 48, it is of interest to note that these alloys are but two of a range of medium strength weldable aluminium-zinc-magnesium alloys. Most of the leading manufacturers are developing their own particular alloy with slightly differing composition, but generally with a total alloying addition of not more than 7 per cent, with a 0.1 per cent proof strengths between 15 and 21 tons/sq-in, and with an ultimate strength between 25 and 35 tons/ sq-in. These alloys include trade names such as DS74, BA733, X7039 and Unidal as well as the two mentioned above, all of which are being used at MEXE to help assess the merits of one over the other. Superalumag and Constructal 21/51 are Continental alloys within the same general group. It is not possible to say yet which particular alloy or alloys will be used on the MGB and the APB.

Yours faithfully, J. H. Joiner, Major RE.

Lieut-General Sir Clarence Bird, KCIE, CB, DSO Polesden Lacey, Near Dorking, Surrey. 5 July 1964

The Editor, RE Journal. Dear Sir,

## LIEUT-COLONEL L. V. S. BLACKER, OBE, TD, AFRÆS

It is interesting to read the letter to the Editor from Lieut-Colonel Blacker, written in 1957, and quoted in the obituary note in the June issue of the *Journal*, in the third paragraph of which reference is made to "those mortars for jam-tin projectiles, extemporized in Flanders, notably by the Royal Bombay Sappers and Miners". This brief sentence involves both confusion and under-statement. Trench mortars and jam-tin hand grenades were quite separate developments, in which the KGVO Bengal Sappers and Miners and the Royal Bombay Sappers and Miners both played a part. The details are well set out in "The Indian Sappers and Miners" (Institution of RE 1948) by Lieut-Colonel E. W. C. Sandes, DSO, MC, RE (retd), pp 445-448.

Yours faithfully,

(Signed) Clarence Bird.

# Memoirs

## MAJOR-GENERAL SIR HORACE ROOME, KCIE, CB, CBE, MC, DL Colonel Commandant Royal Indian Engineers (Retd) Past President of the Institution of Royal Engineers

MAJOR-GENERAL SIR HORACE ROOME died on 29 June 1964, aged 77.

His military career spanned a period of forty years, almost the whole of which was spent in India, or on active service with Indian troops. In the 1914-18 War he served with the Indian Expeditionary Force on the Western Front, where he was awarded the MC, and later in Mesopotamia and in Persia. During the 1939-45 War he held the highly responsible appointments of Deputy Engineer-in-Chief (Works) from 1941 to 1943 and of Engineerin-Chief, India from May 1943 until January 1946—from the days of crisis to those of crowning success, and from the victory of the Indian Armies in the field to the preparation for Independence. For his outstanding services he was created CBE in 1941, appointed CB in 1944 and received the knighthood of KCIE in 1946. He was chosen as the first Colonel Commandant the Bengal Group, Royal Indian Engineers when, in 1946, the title Sappers and Miners was relinquished and the Royal title bestowed upon the Indian Engineer Corps.

After his retirement he devoted a further seventeen years' service to public life in the Isle of Wight. From 1951 to 1953 he was President of the Institution of Royal Engineers and, always keenly interested in the welfare of ex-servicemen, he was for many years Chairman of the Island Branch of the Royal Engineers Association and a member of the British Legion. He was a great supporter of the Boy Scouts' Association and became Island Commissioner and County President. In 1950 he was appointed Deputy Lieutenant for the Island. He served as Chairman of the Group Hospital Management Committee. He was Chairman of the Bishop's Conference on the organization of the Diocesan Conference, Chairman of the Diocesan Dilapidations Board and a Lay Canon of Portsmouth Cathedral. He was for a time President of the Totland Bay Branch of the Conservative Association. He was a keen yachtsman and a member of the Royal Solent Yacht Club. The beautifully-tended gardens of his Totland Bay home frequently provided an ideal setting for fétes in aid of all kinds of worthy causes.

Horace Eckford Roome was born in Tasmania on 17 May 1887, the son of Dr H. A. Roome of Richmond, Surrey. After passing through the Royal Military Academy, Woolwich, he was commissioned into the Royal Engineers on 18 December 1907.

When he had finished his initial training at Chatham he was posted to India in 1910 and joined the Bengal Sappers and Miners at Roorkee. He was one of the officers in attendance at the 1911 Delhi Durbar Ceremonies when Their Majesties King George V and Queen Mary laid the foundation stone of the new capital. He later transferred to the Survey of India for duties in Burma.



Major-General Sir Horace Roome, KCIE CB CBE MC DL Colonel Commandant Royal Indian Engineers

He was promoted Captain shortly after the outbreak of war in August 1914 and towards the close of that year he was posted to the Western Front. After a year in France and Flanders he left with the Indian Expeditionary Force for operations in Mesopotamia. In 1917 he returned to Roorkee to command 52 Field Company Bengal Sappers & Miners which was soon afterwards engaged in operations against the Marris in the Quetta region between Sibi and the Indus. He later took his Company to Persia where he served until the end of hostilities.

In 1919 he returned to India and was employed continuously with the Survey of India up to the end of 1927 working in Mussoorie, Dehra Dun, Nagpur, Pachmari, Hyderabad Sind and Karachi. Then followed a short three and a half years service at home, first at the Railway Training Centre, Longmoor and later in a Works appointment at Tidworth. During the latter appointment he attended the Senior Officers' School at Sheerness.

In April 1932 he was back again in India where he was to spend the remaining fourteen years of his service. After a short tour with the Survey of India at Dehra Dun he was made ACRE, Mhow. On promotion to Lieut-Colonel in August 1932, he became CRE, Poona Independent Brigade Area, and he held that appointment for almost four years. In August 1936 he was promoted Colonel, with seniority back-dated one year, and appointed Deputy Engineer-in-Chief at Army Headquarters. In August 1939 he became Chief Engineer, Northern Command with the rank of Brigadier. In November 1941 he became a Major-General and took over the appointment of Deputy Engineer-in-Chief (Works) India. In May 1943 he succeeded Major-General R. L. Bond, as Engineer-in-Chief, which appointment he held until January 1946. During his time as Engineer-in-Chief he carried a heavy burden of responsibility for the build-up to support the offensive of the South East Asia Command in Burma and Malaya and General Stilwell's Chino-American forces, and to convert India into a base of operations and a reception and training area for the whole force within its frontiers. To accelerate the construction of airfields in Assam and Bengal for the airforces supporting troops of the 14th Army and for American transport planes carrying men, equipment and supplies to China over the Himalaya Mountains, he organized a General Reserve Engineer Force, working directly under him, known officially as GREF, but more colloquially as "General Roome's Engineer Force". The surrender of the Japanese on 15 August 1945 brought victory, but in its wake came the gigantic task of turning the Indian sword back into a ploughshare, the demobilization and reorganization of the Indian Army and the preparations for the transfer of power from the Crown to the two newlyemerging Independent Nations of the partitioned sub-continent.

After his retirement in January 1947 he remained keenly interested in Corps affairs. He was Chairman of the Isle of Wight Branch of the Royal Engineers Association, and from 1951 to 1953 he was President of the Institution of Royal Engineers and he used to travel regularly up from the Island to London for Institution meetings. He steered the Institution most ably through a difficult financial time, and during his presidency the RE Corps Library, as it exists today, was established in the old lecture theatre of the RSME Main Building.

He was asked to get the local Boy Scouts' movement going properly again after the war and he became Island Commissioner in December 1946. He managed to find suitable men to act as District Commissioners and by his inspiring leadership he succeeded in working up the enthusiasm of the various Scout Groups so that when he resigned in April 1954 the Isle of Wight Boy Scouts Association was a most flourishing concern. Shortly after the death of the County President he took over that office which he held from March 1956 until October 1960.

He was Chairman of the Isle of Wight Group Hospital Management Committee. He was a devout churchman; he was Vice-Chairman of the Totland Bay Parochial Church Council, Chairman of the Portsmouth Diocesan Dilapidations Board and a Lay Canon of Portsmouth Cathedral.

He was a member of the Royal Solent Yacht Club and he formerly owned and sailed regularly in *Genista*, a Yarmouth One Design.

He died after a short illness in Frank James Hospital on 29 June 1964. On 2 December 1916 he married at All Saints' Church, Freshwater, IOW, Helen Isabel, eldest daughter of Colonel W. S. Walford, RA of Warden Lodge, Totland Bay. Of their four children the only daughter, who married Major (now Colonel) P. A. Porteous, VC, RA, died in 1953, the eldest son is now a Lieut-Colonel in the Corps, the second a Captain in the Royal Navy and the third is a solicitor practising in London.

Among the many tributes paid to General Roome are the following:-

Field Marshal Sir Claude Auchinleck, GCB, GCIE, CSI, DSO, OBE, LLD, writes:-

"It is with great sorrow that I have heard of the death of Horace Roome. We worked together very closely in Delhi before the Partition of India and I always had the highest regard for his wisdom, charity and breadth of view. His loyalty and efficiency were, of course, beyond question. Delightful to work with especially when the times were difficult. I came to look on him as a staunch friend, and it is as a friend that I mourn his loss."

Lieut-General Sir Francis Nosworthy, KCB, DSO, MC, Colonel Commandant RE (retd) writes:---

"Horace Roome and I entered 'The Shop' together in December 1905 and were commissioned in the Corps in December 1907. Over six feet tall he was a fine athlete, concentrating chiefly on rowing, tennis and rugger which he played regularly for the SME. But I remember him chiefly for his character. He was, I think, the straightest man I have ever known, modest, steadfast and entirely reliable, thinking only of the job in hand with not the slightest regard for his personal advancement which, I am quite sure, never entered into his head. He did not seek popularity, but he was greatly esteemed by all who served with or under him. Throughout his service he fully upheld the honour and reputation of the Corps of which he was always proud.

I would like to extend my sympathy to his devoted wife and to his family in their great loss. He will be missed by many."

Lieut-General Sir Harold Williams, KBE, CB, writes:---

"A fortnight before he died Horace wrote inviting me to his home. Before I could reply he was desperately ill and a few days later he had died. My feeling was one of grevious loss.

"I knew him first when he was Deputy E-in-C, India, and on and off during the next nine years I was privileged to work in close touch with him. Privileged—because of the confidence, enthusiasm and contentment he communicated to all of us and the seeming ease and sound judgement with which he tackled our problems.

"I saw him from time to time confronted with those heavy demands which

were made on Engineers during the war, and his immediate reaction was always: 'they must and can, of course, be met'. Then quietly, logically and frankly difficulties were examined discussed and overcome and those responsible got on with the job. He inspired confidence also in those to whom he was responsible—the Staff, the Navy, the Air Force and the USA Staff. All of them knew that he would give them sound advice and whatever help he could. They liked him, and that made our task much easier. He had vision too, the GREF, the SME at Roorkee, the Engineer Resources Directorate and many other innovations testify to his foresight and his courage. And many of us had reason to remember him as a very sincere friend in time of need.

"He was by nature straight and open, and he found disloyalty and dishonesty in any form very distressing. He took it for granted that most people acted honourably, and I remember him telling me the special pains he took to defend the actions of his officers before the Public Accounts Committee. We had a doughty champion.

"But it is perhaps as a father that some of us will long remember him. The warm hospitality of his house in Tughlak Road before the war; the terrible day when *Prince of Wales*, in which his second son was serving, was sunk and the riotous Christmas dinner a week or so later when a familiar voice at the front door called 'You there, Skipper?'; the further years of anxiety when this same son was a PW, and finally the days after retirement when there were nearly always some members of his family, and their families, with him and Lady Roome at St Lawrence—always being happy and communicating happiness.

"All who knew him were deeply grateful for his friendship. He gave it freely, taking it for granted that others were as warm-hearted and frank as himself. Perhaps his very nature brought out the best in people. He would have been surprised to hear it said, and he would certainly not have made the claim himself, but it sums him up."

Major-General R. L. Bond, CB, CBE, DSO, MC, writes:-

"Talking to a friend in the Isle of Wight of Horace Roome he said that he had the deep regard and affection of a widespread circle of people for his kindness, his goodness and his wisdom. Those of us who had the privilege of working with Horace Roome know well how those qualities shone through his life and actions. When the writer was brought in as Engineer-in-Chief in India, though junior in age and in the Corps to Horace who was Deputy E-in-C, a lesser man than Horace might rightly have felt some sense of grievance. Not so this noble-hearted man. So began one of the happiest of partnerships. It was a time in 1942 when the work of the Corps in India was expanding by leaps and bounds. During that year we initiated a vast programme of airfield construction at a moment's notice. We were engaged in a great programme of road construction on the Burma Front including the commencement and survey of the famous Burma Road; we were presented with a huge hospital construction programme, naval works in a dozen ports in India, an expansion of units, forestry units, mechanical construction units, the General Reserve Engineer Force. Our resources were stretched to the uttermost. Without Horace Roome's extensive knowledge of personnel (he could always think of the right man for the job in hand), his wide engineering experience in India, his unfailing good humour and firmness in the endless Committees that all this work entailed, it would have been quite

impossible for the Corps to have coped successfully with its heavy responsibilities. He was a great Sapper.

"But with all this the moment that comes more clearly to mind than any other was in later years. The writer, then a Scout Commissioner, had taken a party of very raw Sea Scouts to camp near Cowes and Horace was then County Commissioner. We had been for a sail and as I brought the whaler alongside the jetty in a tricky condition of wind and tide, rather skilfully I hoped, one of the boys seized the anchor and dropped it overboard pinning me against the stern and quite spoiling the operation. Horace Roome was standing in his Scout's uniform on the jetty watching, and the slightly sardonic but delightful twinkle in his eye at his old friend's predicament remains an unforgettable memory."

CGL recalling his early days with the Survey of India writes :---

"Horace Roome joined the Survey of India in February 1913 and after three months in Calcutta was posted to No 11 Party in Burma. In November 1914, with some eighty other Sapper officers in civil employ in India, he reverted to Military Duty for the period of the 1914–18 War. In November 1919 he rejoined the Survey in No 1 Party. From then on until 1928 he served with topographical parties working for the most part in the Central Provinces and in Sind, and recessing in Mussoorie, UP during the summer.

"By 1928 Roome was feeling that the restricted scope of a Specialist Department did not offer enough promise for the future. In this he was right as events proved. But those were early days, and we who remained saw him go with regret. We lost a man of great integrity, with whom I have been glad and fortunate to remain in touch in later years."

CEAB writes:---

"Having served originally with Horace Roome when he was a major at the Railway Training Centre, Longmoor, though considerably junior to him, I soon realized what an exceptional officer he was with a special gift for making himself thoroughly understood by his subordinates and obtaining their fullest co-operation.

"These same gifts were again clearly displayed during his time as Engineerin-Chief, India when I served under him again. This was a complex and difficult time for the E-in-C, with the war almost won and with the great problems of Partition already looming ahead. Moreover there were conflicting loyalties calling for firm control and guidance. Horace Roome was indeed the man for the job, leading his subordinates clearly and firmly in the right path ahead, and always keeping a continuous control over the priorities of varied and competing bids. Indeed so clear, calm and eminently reasonable was his control that friction was virtually absent and an able, though strong-willed team of Sapper experts of all types, Sappers & Miners, Works Services, Transportation and Stores were smoothly, but firmly, led to make their combined maximum effort towards hastening the end of the hostilities and shortening the time required to conclude the difficult post-war period of clearing-up and returning to peace-time conditions. The undoubted success with which this was achieved owed much to Horace Roome's genius for leadership and ability to simplify and unite, apparently conflicting demands."

FLWE writes :---

"In April 1964, I was appointed Secretary to the Isle of Wight Group Hospital Management Committee on transfer from a similar appointment at R.E.J.-M Farnham, Surrey. At Farnham, I had had the privilege of serving under General Sir Robert Haining, and in my new appointment on the Island I was delighted, and not a little relieved, to discover that my new Chairman was also a distinguished soldier and an exceptionally able administrator.

"Sir Horace Roome's principal post-retirement interest was unquestionably the hospital service. He had been a member of the Isle of Wight Group Hospital Management Committee since the implementation of the National Health Act in July 1948, and in the following year he was appointed Chairman. The problems of the new service were many and varied; eight hospitals of widely disparate origins, traditions, functions and sizes were compounded into an uncasy amalgam and placed under one Committee of Management. And because that Committee was led by a man of experience and wisdom, the unease was soon dispelled, and an efficient and integrated hospital service steadily evolved. Under Sir Horace's firm but unobtrusive guidance, the medical staff gradually lost their fear of lay interference, old rivalries between local authority and voluntary hospitals disappeared, and the Hospital Management Committee were soon enabled to administer the units under their control as a group in fact as well as in name.

"During his period of office, Sir Horace worked consistently for the improvement of the hospital service in all its aspects. He pinpointed deficiencies, particularly in standards of accommodation and equipment, and directed all his energies to remedying them. He drew up a systematic development plan and saw it largely realized; a new nurses' home was built at St Mary's Hospital, Newport, in 1954, and a unit for seventy-five elderly psychiatric patients was opened at the Island's mental hospital three years later. Medical and surgical equipment was brought to the highest standard, the diagnostic X-ray departments throughout the Group were furnished with some of the most advanced apparatus in the country, while the introduction of modern furnishings and architecturally conceived colour schemes helped to dispel the atmosphere of dull institutionalism which had understandably persisted throughout the war years and the immediate post-war period.

"These achievements will remain as a lasting memorial to Sir Horace Roome's Chairmanship of the Isle of Wight Group, which he held for twelve notable years; but he had no hesitation in applying to himself the same criteria which he applied to others, and in 1961, at the first evidence of advancing years, which only he could perceive, he did not seek re-election but handed over control to a fellow Major-General, General F. M. Hext of the Corps of Royal Electrical and Mechanical Engineers.

"Sir Horace died in one of the hospitals he served so well. He will be mourned by many throughout the Island, for he gained the respect of all who knew him and the affection of all who knew him well."

JDEB writes :---

"After his retirement Sir Horace Roome took an active part in local affairs. The Rt Rev W. L. S. Fleming (now Bishop of Norwich), as Bishop of the Diocese of Portsmouth, was quick to turn to General Roome for help in many spheres of ecclesiastical administration within the diocese. One of the most complicated and difficult problems within the Church of England is that of the care, maintenance and improvement of the benefice parsonage houses; money is invariably insufficient to tackle all the work which is urgently required, and the procedure is involved. General Roome accepted the appointment of Chairman of the Portsmouth Diocesan Dilapidations Board and tackled these problems with energy and foresight, with the result that during his Chairmanship from 1957 to 1961 tremendous improvements were seen in the living conditions of the clergy.

"Sir Horace was also asked to chair a commission appointed by the Bishop to examine the whole question of the government of the church within the diocese and the representation of the laity through the Diocesan Conference. Here again was an opportunity for him to serve the Church in his quiet and efficient way, and those who worked with him on these various bodies could not fail to appreciate his great qualities as a Chairman who really wished to see things done.

"General Roome was a loyal member of his parish at Totland Bay, and served for many years as Vice-Chairman of the Parochial Church Council; both there and throughout the Diocese as a whole he will be greatly missed.

"As a tribute to his services to the Diocese Sir Horace Roome was appointed a Lay Canon of Portsmouth Cathedral, an office which he held from 1958 to 1962 when ill-health compelled him to take a less active part in public life."

A brother officer, CAB writes :---

"In honouring the memory of Horace Roome two quotations that immediately come to mind are 'Whatsoever things are true . . . honest . . . just . . . pure . . . lovely . . . of good report; if there be any virtue . . . praise, think of these things' and 'remembering without ceasing your work of faith and labour of love'.

"The privilege of fifty years of friendship has provided the foundation for these recollections; and the proof that these characteristics are just as needful and potent in our lives today, and will continue to be in the future, as they have been in the past."

### BRIGADIER F. C. NOTTINGHAM, DSO, OBE

FRANK CATO NOTTINGHAM was born on 22 September 1898. He was educated at St Paul's School and the Royal Military Academy, Woolwich from where he was commissioned into the Royal Engineers on 6 June 1918.

In the autumn of the following year he was posted to the QVO Madras Sappers and Miners and served with both the 64th and 63rd Field Company of that Corps in Mesopotamia before being appointed Assistant Adjutant at Bangalore.

In October 1923, he returned home to attend No 12 Supplementary Course consisting of thirty-one Sapper officers many of whom had seen considerable war service. Officers on this course were sent for a year to Cambridge University and Nottingham became an undergraduate at Jesus College.

His Supplementary Course completed, he was posted to the Sudan where he spent six years serving in the Sudan Defence Force and with the Public Works Department at Khartoum. On returning to the home establishment in the first half of the 1931-2 trooping season he was posted to Aldershot as Second-in-Command of the 23rd Field Company, which with the 12th and 26th Field Companies then comprised the 1st Divisional Engineers, and in January 1935 he was made Adjutant RE of the 2nd Division. During his six and a half years of those pre-war days at Aldershot Nottingham took an active and enthusiastic part in everything-the unbroken training cycle from trades training in the winter to collective training and summer divisional manoeuvres, the annual march to Wyke Regis Bridging Camp, Sapper assistance and participation in the Aldershot Tattoo and the Aldershot Horse Show, hunting in the winter and the RE Aldershot Point-to-Point Races each March, the RE Week and the RE coach trotting gaily each day from the Officers' Mess, Gibraltar Barracks to Ascot Races, and finally the passing of the historic horse-drawn RE tool cart and the Mounted Sections and the "motorization" of the Field Companies.

From Aldershot he was posted in 1998 to Hong Kong and given command of 22nd Fortress Company; he was, however, later made SORE to the Chief Engineer. He left Hong Kong at the end of January 1940 before Japan entered the war.

His most outstanding war service began with the Normandy invasion in June 1944 when he was CRE 7 GHQ Troops Engineers forming part of 102 Beach Sub-Area. He had under his command five field companies, a field park company, a works section and two stores sections, two artisan works companies, two mechanical equipment sections, elements of a workshop and park company, two port operating companies and an IWT operating company and a bomb disposal section—a truly formidable and representative collection of RE units. Their tasks consisted of the clearance of beach obstacles, the construction of exits from the beaches, water supply and the general establishment of the Sub-Area beach maintenance organization. Despite heavy casualties, congestion and delays afloat his Sappers were able to accomplish all their tasks, due largely to the most comprehensive briefing they had received beforehand from their CRE and their knowledge of the essential things that had to be done.



In August 1944 Nottingham was appointed to command 13 AGRE for operation Veritable-the clearance of the west bank of the River Rhine. On 11 February 1945 the Chief Engineer First Canadian Corps made him responsible for opening and maintaining the roads from Mook to Groesbeck, and thence along the axis of the 51st and the 53rd Divisions, placing at his disposal 23rd Airfield Construction Group, 2nd Canadian Army Troops Engineers and 50th GHQ Troop Engineers. Later he was to be responsible for other roads. Stone was brought up to Mook by rail at the rate of 600 tons daily and considerable quantities of mechanical plant were made available. One part of the axis of the 51st Division was so bad that it proved necessary to build a cordurov diversion, nearly a mile long, to take the traffic whilst repairs were carried out. This was built remarkably quickly by the Canadians who were experts at the job and was called, for obvious reasons, the "Livercure Mile". The most celebrated jeep, and almost the last, to drive along it carried the Supreme Commander, General Eisenhower, and the Prime Minister, Mr Winston Churchill. Finally the 2nd Battalion RCE was also put at his disposal and employed on converting the Groesbeck-Kranenburg railway into a tank track.

## Brigadier FC Nottingham DSO OBE



Lieut-General Dempsey, GOC, Second Army opening Westminster Bridge as a symbol of the completion of all bridges over the Rhine in the Second Army area. Colonel F. C. Nottingham is standing on General Dempsey's right.

# **Lieut-General Dempsey GOC**

Following the successful advance to the Rhine, Nottingham, still commanding 13 AGRE, was placed in charge of the engineer arrangements for the Rhine Crossing on the XXX Corps front. He was allocated the Divisional RE of 3rd and 43rd Divisions, 5th Assault Regiment RE, II Canadian and XXX Corps Troops Engineers, 6th Army Troops Engineers, 8th, 18th, 50th and 59th GHQ Troops Engineers, Bomb Disposal and Mechanical Equipment units, a Bridge Company RASC, four Pioneer Companies and a Royal Naval Detachment.

Here again it was due to his foresight, minute study of technical and organizational detail, most careful briefing, drive and inspiring leadership that this river crossing operation, one of the greatest in military history, was successfully accomplished.

After the German surrender he was appointed Deputy Chief Engineer, and then Chief Engineer, 5th Divisional District at Brunswick where his tasks included the rehabilitation of the war-devasted country, the construction of new bridges, the clearance and repair of roads and canals, the reopening of railways and the repair and provision of accommodation for the services and for displaced persons.

For his war services he was mentioned in despatches and awarded the DSO and OBE.

In November 1948 he became Chief Engineer East Anglian District and in February 1951 he was promoted Brigadier and appointed Chief Engineer Western Command. He retired in 1953.

After his retirement he became Commandant of The Gordon Boys' School, Woking and he held that position until 1962, when ill-health compelled him to resign. During his nine years at the school he devoted himself wholeheartedly to the well-being of the boys in his care. He soon realized the need for modernizing the school and, with great enthusiasm, he drew up a farreaching programme for improvements to the buildings and for extension of the playing fields, all of which he was able to see well on the way towards completion before his retirement. It was during his time as Commandant that the statue of Gordon-a replica of the one outside the RSME Main Building-was repatriated from Khartoum, where he had served as a subaltern and presented to the Gordon Boys' School. It was unveiled on 14 May 1960. He took great trouble in selecting the most aesthetic setting for the statue and in the design of its plinth. In an article in the Journal describing the unveiling, he said that there was no truth in the rumour that negligent boys were told to run round the playing field and "report to Gordon"in the same way that equally negligent GCs at the Shop in the old days used to be ordered to "report to the Prince Imperial".

Today, thanks to his personal efforts, the School has modern and up-todate facilities for education, housing and recreation which bears comparison with others of its type and size.

After leaving the School he continued to live near by and maintained a close interest in all its activities and was engaged on writing its history. Unhappily he was not long to enjoy his retirement. He died suddenly on 22 April 1964. A memorial service was held for him in the School Chapel last June.

In 1928 he married Muriel Phyllis, daughter of Philip Webster Butcher, Esq, of Norbury. They had one son, now a Major in the Corps, and two daughters. Our deepest sympathies are extended to his widow and family.

## BRIGADIER E. M. S. CHARLES, CMG, DSO

BRIGADIER ERIC MONTAGU SETON CHARLES, a younger brother of Lieut-General Sir Ronald Charles, KCB, CMG, DSO, Chief Royal Engineer 1940-6, died at Ulverton, Lancs, on 30 July 1964, in his eighty-seventh year.

He was the third son of Deputy Surgeon-General T. Edmondstone Charles, IMS, Honorary Physician to Queen Victoria, and Ada, daughter of General Francis Rundel, CSI, RE. He was educated at Winchester and the Royal Military Academy, Woolwich and he was commissioned into the Royal Engineers on 1 January 1898.

He saw service in the Boer War with the 1st Field Troop and with Balloon Sections. He remained in South Africa after the end of the war serving with 47th Fortress Company. On returning home in 1905 he completed his disturbed Young Officer training at Chatham and served consecutively with the 38th Field Company, then stationed at Chatham, and with the RE Depot when, on promotion to Captain, he was given command of B Depot Company. From November 1907 until November 1910 he was Adjutant of the Training Battalion. He was a good athlete and a proficient oar, and during his long tour of duty at Chatham he took a prominent part in sports of all kinds.

After leaving Chatham he was posted to Dublin to command 14 Survey Company, but shortly after the outbreak of war he was sent to the Western Front. After only a short stay in Flanders he was transferred to the Mediterranean Theatre where he saw service on the Salonika front firstly in command of the 100th Field Company and later as CRE 10th Division. In September 1917 his Division joined the Egyptian Expeditionary Force which took part in Allenby's victorious campaign in Palestine. For his war service he was mentioned in despatches five times and awarded the DSO in 1917 and the CMG in 1919.

After the defeat of the Turkish forces in Palestine he became CRE Cairo for a short time before being selected to attend the Staff College, Camberley. On graduating from there he served in a second grade General Staff appointment at the War Office and in 1923 he became SO RE1 at Murree, Northern Command, India. He held that appointment for two years and then became CRE Rawalpindi District. In March 1927 he was promoted Colonel, with seniority back-dated to January 1922, and in July of that year he became Chief Engineer, Southern Command, India. He became a Brigadier in June 1928 and during 1930 he officiated as Commander, Bombay District. His last appointment was in command of 161 (Essex) Infantry Brigade (TA) at Brentwood. He was appointed ADC to King George V in September 1931. He retired in February 1935.

On 20 April 1911 he married Lola Beatrice, daughter of W. F. Powell of Ottawa at Christ Church Cathedral, Ottawa. They had one daughter. His wife died in 1948. GILBERT KENNEDY CASSELS, known to his friends as "Cassy" was born in the Argentine on 28 December 1900. He was educated at Rugby School and the RMA, Woolwich where he was in the Saddle Ride. He was commissioned into the Royal Engineers in July 1920.

Having completed his Young Officer training he was posted to Bangalore where his long connexion with the QVO Madras Sappers and Miners began. After a short period as Assistant Adjutant he joined 9 Field Company in 1924 which moved to Waziristan the following year. On returning from a long leave at home he spent a few months in command of a Depot Company at



Colonel G. K. Cassels, OBE

Bangalore and in 1927 he was posted to 33 Field Troop at Sialkot. In 1929 he was selected to attend a long course at the Indian Army Equitation School, Saugor and having distinguishing himself on the course he returned, after a further home leave, to 33 Field Troop, then at Bangalore. During the Burma Rebellion, 1931–2, he served with 14 Field Company Madras Sappers and Miners and his name was brought to the notice of the Commander-in-Chief,

## Colonel G K Cassels OBE



Q.V.O. MADRAS SAPPERS AND MINERS POLO CLUB, 1933

Standing—Capt D. R. Vachell, MC, Lieut J. R. S. W. Elkington, Capt W. S. Cole, Capt F. H. R. French, Lieut J. F. Godwin Sitting—Capt P. A. Tucker, Major M. M. Jeakes, MC, Lt-Col E. Bradney, DSO, Capt G. K. Cassels, Capt H. E. G. St George

**QVO Madras Sappers and Miners Polo Club 1933**
India, for his distinguished service during the operations. He then returned to Bangalore to command 44 Divisional Headquarter Company. In 1934 he was appointed Assistant Superintendent of Park and the following year he was made Second-in-Command of the Training Battalion at Bangalore. In March 1938 he left the Madras Sappers and Miners to join the Military Engineers Service as Garrison Engineer, Meerut, where he was promoted Major.

No record of Cassels' time with the Madras Sappers would be complete without a mention of his enthusiasm for polo. He was an accomplished horseman, a splendid trainer of polo ponies and a great player. Between the years 1928 to 1935 he trained hard with the Madras Sappers and Miners polo team which achieved notable successes in tournaments in Bangalore, Madras, Hyderabad, Mysore, Ambala and Delhi. Of his many cups he particularly valued the Champion Light Weight Polo Pony Cup, won at the Madras Show in 1934 and another-the Sir George Stanley Polo Cup-won by the Madras Sappers in 1933 and presented by Lieut-Colonel Sir Velugoti Sri Govinda Krishna Yachandruluvaru, Maharaja of Venkatagiri, KCIE, Honorary Colonel of the 11th (Madras) Battalion, a grand old man, kindly, hospitable and loved by all, who did so much for polo in the twenties and thirties. In 1937 Cassels presented a Challenge Cup to the Madras Sappers for a competition to encourage novices to train their own polo ponies. This cup is still competed for; when the motor vehicle replaced the pony Cassels' permission was sought and obtained for a change in the conditions of its award. The cup is now presented each year to the best learner driver.

He greatly enjoyed fishing and also took part in rough shooting in Scotland when on leave with his family and in Wazirastan where he went after bear and thar in the State of Chamba in Kashmir.

Brother officers of the Madras Sappers of his day pay him the following tributes:-

"On the polo ground Cassy was in his element. A thrusting horseman, he gave the game all he had and was a real asset to any side. His absorption in schooling his ponies and training for a Tournament was only matched by his infectious delight in the game itself. With a scatter gun he was equally keen and energetic and it had to be a very wily snipe to get out of range alive."

"I remember Cassy as a great enthusiast about everything he did, whether work or play. His motto always seemed to be 'if it is worth doing at all it is worth doing to the best of one's ability'. He went at everything hammer and tongs and no detail was too small to attend to.

"He took the greatest interest in his men in the Madras Sappers, found out all about them and had the great gift of remembering faces and personal histories.

"He was a very keen horseman and went in for every kind of mounted sport with his usual thoroughness. Polo was his great love and the Madras Sapper polo owed much to him. He achieved a handicap of three and 'went like hell'. He might well have risen to a higher handicap had he been able to continue playing in a team with others better than, or at least as good as, himself, but latterly he was the star turn of the Corps team and had to 'carry' other not-so-good players. Also his increasing deafness became something of a drawback to him.

"Cassy was one of the most straightforward and honest men I have ever had the good fortune to know. His word was his bond, he was intensely loyal and he worked hard. His standards were high; he expected a lot from others but he never spared himself. In spite of his increasing deafness he was always cheerful and seemed to enjoy life to the full. No one could wish for a better friend and the world is the poorer for his passing."

"This is a short personal memory of Cassy based on a friendship which grew over a short period of three years in India and lasted for many years afterwards until his untimely death this year. It is necessarily incomplete.

"It is no exaggeration to say that polo in Bangalore in my day was Cassy; he was the engineer, the trainer, the driving force behind all the schooling, the practice, and the game itself.

<sup>47</sup>We all used to roar on the polo field in those days, not the least Cassy. But then he suffered from the affliction of deafness so there was more excuse for him—besides he was the skipper and we were not.

"I well remember the pre-Tournament conferences where we used to work out which ponies to play in which chuckers and when Cassy used to give us hints and tips and criticisms. How difficult a thing it is to criticize a sensitive person, but Cassy did it with an ease of manner which removed all tension from the discussion. I can see and hear him now with that engaging rather sideways and almost self-deprecating little smile, that quiet kindly voice.

"As our skipper Cassy was much the best and the most experienced player holding us rabbits together, ubiquitously energetic, quick to think and act, vociferously encouraging us on.

"I never served under Cassy but, as the purveyor of line ponies, I had many dealings with him during my three seasons of polo in Bangalore. He was not the 'angry Sahib' I had at first taken him to be—far from it. He was gentleness and fairness, loath to give or cause offence in any way, kindliness and helpfulness. He was a good man if ever one walked, or rode a polo pony."

Cassels was on leave in Kashmir when war broke out in September 1939 and he hurried back to duty at Meerut. He was retained there until 1940 when he went to the Middle East. He served at Khartoum, where he held the grandiloquent title of 'CRE Nile', under Colonel (later Brigadier) G. F. H. Alms, the Chief Engineer of General Platts' force which eventually defeated the Italian Army in Eritrea. The engineers of the force initially consisted of the Sappers and Miners of the 5th Indian Division, the 6th and 8th Army Troops Companies and the 16th Workshop and Park Company S & M. Their tasks included the development of water supply, improvement of roads and ford and ferry crossings over the Atbara and other rivers. In view of the Italians vast superiority in numbers preparations for defence were also necessary. These consisted of the construction of concrete pill boxes, wire obstacles, minefields and arrangements for the cratering of airfields. Cassels was later posted to the Canal Zone in Egypt and in 1944 he became a Deputy Chief Engineer in Burma where he was awarded the OBE.

He came home on leave in 1945 and he married 2nd Officer Eleanor Joyce Burnett, WRNS only daughter of the late Colonel S. H. Burnett, IMS and Mrs Burnett of Roquebrune, Cap Martin. He returned to New Delhi later that year to become Deputy Director of Works and remained there until the hand over of power in India. He then returned to the War Office as ADFW E8 where he served until his retirement in January 1950 when he almost immediately sailed for the Argentine with his wife and adopted daughter Christina, to join his brother and two sisters there. On one of the

#### MEMOIRS

family's Estancias he soon became absorbed in the business of stock breeding and fattening, and the cultivation on a large scale of crops for grazing also treating, innoculating, dehorning and classifying with tremendous thoroughness. Unfortunately there was little time left for any special attention to draught or riding horses, though he still enjoyed many hours in the saddle. Many a Peón will still remember his exhortations!

For a man with so much drive and zest his deafness was a serious infliction, yet he remained absorbed in the job in hand, and carried out everything he did with great enthusiasm.

Nine years later he retired in Somerset and in a small way was rearing calves for beef—and in those last five years had begun to earn a reputation in the local fat stock trade. Tireless in spirit he drove himself on, with failing health and died on 29 April 1964 and is buried in the ancient churchyard of St Lawrences, Rode, which he had come to love with unusual fervour.

IRSWE writes :---

"Cassels will be remembered gratefully by many Madras Sappers, both British and Indian. His name will not be prominent in the history books but will live in the hearts of those who were fortunate enough to know and serve with him. For almost a generation, 'Cassy' was closely associated with Bangalore—it was impossible to think of Bangalore without 'Cassy' and of 'Cassy' without his horses. A casual observer seeing the time that 'Cassy' gave to his string of polo ponies might well have thought that these were his life. They were, but only one side of a many-sided life. 'Cassy' had a fire inside him, a burning enthusiasm for anything he took up, be it work or play. He was painstakingly thorough but when everyone else was getting a little tired 'Cassy's cheerful grin would break out and we would all feel better.

"During many years of our acquaintance 'Cassy' was troubled with increasing deafness. After one leave home he came back with a specialist's verdict that there was no hope of an absolute cure. This must have been a greater blow to him than many of us realized at the time, for he was a keen soldier and, but for this disability, he would have gone further up the ladder than he did. 'Cassy' accepted this handicap bravely and carried on playing polo. Having a deaf ear did not stop 'Cassy' having a sympathetic ear; he was always a kind, sympathetic and incredibly patient listener.

"Visiting 'Cassy' at his home in Rode, Bath, after his retirement was reminiscent of India. True there were no horses, but lots of bullocks; no Mali was working in the Compound, but 'Cassy' was doing farm work with all his old enthusiasm unabated and dropping the task to give you a generous welcome. Just as in India too, the married officer with rooms in his house to spare had given quarters to a bachelor, also a retired Madras Sapper.

"I know that I speak for many in saying that the friendship of this generous man has enriched our lives."



THE tragic death of Lieutenant M. R. Handfield-Jones, RE in June 1964, killed on active service in the Aden Peninsular, has robbed the Corps of a personality and an outstanding Rugby player. He was commissioned into the Corps of Royal Engineers on 19 December 1958, gained a degree at the Royal Military College of Science, and was posted to 3rd Independent Field Squadron, RE.

He was Captain of Rugby Football at Rugby School and the RMA, Sandhurst, and he later played for Hampshire, the Combined Services and the Harlequins. He represented the Army and captained the Corps team for the past two seasons. By an irony of fate in his rugger life, during his captaincy he was unable to achieve the aim of leading the Corps to victory against the Gunners, because in both years, injury just before the game, enforced a spectator's role on him. The Army Rugby Union reported his death with deep regret stating, "A fine centre three-quarter, he played on twenty-five occasions for the Army, and it is in no small measure, due to his intelligent and thrustful play that the Army won the Services' Championship in seasons 1962–3 and 1963–4."

The loss will be felt by all who knew him, who are more than he knew. Those who only knew him by sight will miss seeing his neat lithe figure making a break through in the centre, or in defence, see his tidy tackle

# Lieut M R Handfield-Jones

break up an opposition attack. Those who met him will remember how with his unassuming air, belied by a mischevious smile, he quietly got on with his work and play.

From Aden his squadron commander writes: "Mike Handfield-Jones joined 3rd Independent Field Squadron in May 1963 and immediately took command of 2 Troop. His charming manner and willingness quickly earned him affection from all ranks and particularly from his fellow officers. He was always anxious to learn and served selflessly. His troop, to whom he was known as 'Hanny', had great respect for him and served him loyally and well. He was killed accidently on the night of 1 June 1964 while operating with his troop in the Radfan area in support of the 1st East Anglian Regiment.

That he was a friend of all made his death a personal matter, and we all share in our measure the grief suffered by Mike's family, to whom we tender our deepest sympathy." K.B.F.

### G. R. SISSON, OBE, MA

GEOFFREY ROX SISSON died suddenly at his home on 11 May last. He will be affectionately remembered by many Sapper officers passing through the Shop and, more recently, through Sandhurst.

After taking a First Class in Mathematical Moderations at Oxford he was commissioned into the Gunners in 1915 and served in Sierra Leone and on the Western Front. He returned to Oxford after the war and obtained a First Class in the Final Honours School of Mathematics in 1921.

He joined the staff of the RMA, Woolwich in January 1922 where he served continuously until the Shop closed down in 1939. In addition to his duties as a Lecturer in Mathematics, he entered wholeheartedly into the extra-mural activities of the Academy. He ran the soccer second eleven for many seasons —he had been captain of soccer and cricket at School and he obtained his College colours for soccer at Oxford—and he was an ardent golfer, playing regularly in the Dunn Cup and the Inter-Department Competitions.

On General Mobilization in 1939, Sisson was posted, with the rank of Captain, as an Instructor at the Gunner 121 OCTU, and in 1941 he was promoted Major to become Chief Instructor in Survey at Larkhill.

During the discussions regarding the amalgamation of the RMA and RMC, Sisson was frequently consulted and when the newly-formed Royal Military Academy, Sandhurst came into being in 1947, he was appointed Head of the Department of Mathematics. He held that post until he reached the official retiring age in 1956. He continued, however, to serve thereafter as a member of that Department until his final retirement in April 1959 when he became Senior Mathematics Master at Abbotshohne School, Derbyshire.

Both his sons served in the Royal Regiment. The elder was commissioned during the last war. The younger passed through Sandhurst and became an Under Officer; he left for civil life later but continued his Army connexion by joining the Honourable Artillery Company.

# COLONEL/AIR COMMODORE L. F. BLANDY, CB, DSO

AIR COMMODORE BLANDY who had a long and distinguished career in both the Royal Engineers and the Royal Air Force died in Folkestone on 7 June 1964, aged 89 years.

The following obituary notice, published in *The Times* of 8 June 1964, is reproduced with the permission of that newspaper.

"Lyster Fettiplace Blandy was born on 21 September 1874, the son of Adam Blandy, of Abingdon. He was educated at Haileybury and the Royal Military Academy, Woolwich and was commissioned in the Royal Engineers on March 26, 1895. On the conclusion of his time at Chatham, he attended a course in Submarine Mining at Plymouth and then went abroad to Bermuda and Jamaica and then to Victoria, BC, and in 1904 to Halifax, Nova Scotia where he served in Submarine Mining and Fortress Companies. He returned home in 1906, when he was posted to Pembroke Dock. In 1909 he was appointed Assistant-Inspector of Royal Engineer Stores—Royal Dockyard, Woolwich.

The end of his appointment at Woolwich in 1913 coincided with the expansion of the Royal Engineer Signal Service and he went to Aldershot to command the GHQ Wireless Unit. Although this was merged the following year with the GHQ Signal Company it was not long after the arrival of the BEF in France that Blandy found himself in command of the original wireless sections and others that had come out. Under his fostering care wireless in the Army in all its branches, including air to ground working with the Royal Flying Corps, grew from nothing to a reliable means of communication. In fact, Blandy was often accused of cherishing a 'Private Army'. In the summer of 1917 he came back to England and went for just under a year to the Wireless Experimental Establishment, Woolwich.

He went to the Air Ministry in April 1918 as Controller of Communications, in which position, as a Group Captain and Air Commodore, he remained until his retirement in November, 1928.

He was employed during the last war on special duty and was very proud to be in uniform as a serving Air Commodore after his seventieth birthday.

He married in 1905 Violet Mary, daughter of Charles Vernon, of British Columbia.

His funeral service was held at Folkestone Borough Crematorium, Hawkinge, on 10 June. Among those present were Mrs Lyster F. Blandy (widow), Mrs Hamilton Williams (sister), Lady Blandy (sister-in-law), Mr John P. Blandy, Mr Nicholas Lysaght, Mrs Miles, Lady Sudeley, Lord and Lady Harmsworth, Lady MacMichael, Lady Fisher, Colonel and Mrs Sandford, Mrs Stormonth-Darling, Miss Victoria Bromley, Mrs deBurgh, Mrs Trape, Mrs Norman Brooke and Miss Bassett."

# **Book Reviews**

### ON THEIR SHOULDERS

# British Generalship in the Lean Years 1939–1942 By BRIGADIER C. N. BARCLAY, CBE, DSO

# (Published by Messrs Faber & Faber, London. Price 30s)

Brigadier Barclay believes that a military historian with practical knowledge of war should do more than make a mere record of events. He should point the moral and adorn the tale so that posterity, by reading may perhaps avoid the errors of the past. The brigadier's experience of arms began in his youth during the First War and matured in rough times of battalion and brigade command in the Second. So he is well qualified critically to examine the careers of eight generals, who for better or for worse found themselves trying to stem the adverse tides of combat in 1939-42. Based on his well-known accuracy of fact and sober judgment, the author's conclusions are innocent of the harsh injustice, which so often deforms the writings of contemporary military historians. His eight generals all went to well-known public schools and only one of them did not go either to Woolwich or Sandhurst. The continental critic always takes a jaundiced view of this kind of upbringing and declares that it developes an amateurish tendency to regard battles somewhat as games, which can be lost without undue calamity or dire disgrace. A calm outlook allied to efficiency is certainly commendable in war although occasionally it falls short of the heroic ideal. Whatever the odds against them, Winston Churchill regarded defeated generals almost with disdain and seriously considered executing one or two "pour encourager les autres". Unfortunately the shooting of generals and the prodigal shedding of their soldiers' blood will not remove the devastating effect of a sudden unbalance in the strategic situation.

In Malaya, for instance, greater military competence might have gained some extra months of invaluable time, yet probably not enough for the Allies to regain the initiative at sea. Without it the British forces in Singapore were doomed to ultimate defeat just as certainly as were the Russian defenders of Port Arthur in 1904-5. Actually a pale cast of indecision seemed, from the start, to paralyse the British venture. The commanders-in-chief frequently changed for reasons, which are as yet unknown, and no specially able leader took post to handle an undertaking of almost unexampled difficulty and peril. The stage was thus set early on for the dismal tragedy which soon followed.

Brigadier Barclay writes firmly in favour of Lord Gort whose reputation later research has now almost completely vindicated. Worthy of mention is the fact that apart from one disregarded member, who was written off as suffering from overstrain, the British mission at the French GQG paid no heed whatever to the disarray in the French high command. That Gort, too, was unaware of it, is therefore hardly surprising. Another point that should always be remembered is that the success of the withdrawal to Dunkirk owed much at its inception to the stout resistance of French divisions south of Lille.

The question of Greece is the puzzle about General Wavell. The agreed holding of the Vermion line of course never took place. Yet even so to onlookers at the time, the enterprise seemed to be a desperate one. If Winston Churchill had been at Athens in the spring of 1941 instead of Eden, it might not have occurred? The meeting there was not a convincing affair—to say the least of it. About General O'Connor, it is curious that after his great victory at Beda Fomm he was not left in charge of the British forces in the Western desert.

General Wilson gave all who met him the impression of a formidable personality and as such he was perhaps difficult to place. His direct conduct of operations in Greece and Syria is difficult to fault and the essay about him is particularly valuable.

Most readers will agree with the author's view that it was a mistake to remove General Auchinleck from his milicu in India, where he knew everybody, to a totally different set-up in the British service where even the private soldier had become a stranger to him. But he was a great soldier all the same.

The supercession of General Hutton by General Alexander made little difference to the course of events in Burma. A more experienced commander took over the reins and Hutton became his chief of staff—a role which in fact suited him better. Many months were to pass before Commonwealth troops acquired the form required for the defeat of the Japanese in battle.

Quite logically, after such a review of success and failure in battle, the book ends with a short but most valuable appendix on the great worth of vigilant up-to-date training. What might be called the differential of war changes all the time so training must be continuous in every cchelon from the front line to the depots at home bases. Otherwise a disastrous lag in tactics will occur and the troops will suffer.

Those who ever met Brigadier C. N. Nicholson will welcome the sympathetic mention of him and his 30th Inf Bde for the part which they played in the defence of Calais in May 1940. The heroic quality of their resistance made a great impression on the Germans and may have conduced to the decision not to storm the Dunkirk beach-head from the West.

On Their Shoulders is quite a short book which will greatly interest the generation that helped to carry the burden and also those of the younger generation that perhaps read about it. Its conclusions will probably approximate closely to the verdict of history. Time is getting on.

B.T.W.

# THE MODERN UNITED STATES ARMY

# By FORREST K. KLEMMAN, LT-COL AVS RETD AND ROBERT S. HOROWITZ

(Published by D. Van Nostrand Company Inc, Princeton, New Jersey, USA.

# Price 403)

This book has been dedicated to the American Soldier, and although its main character is the ground combat soldier, a detailed account is given of the training of young officers, NCOs and men, their weapons and the organization and policies that prepare them for their respective individual role, be they professional, reservist or "inducted citizen" (National Serviceman).

The authors, both well-known American military writers, received the co-operation and assistance of the publishers of the magazine *Army Times* and the Office of the Chief of Information, Department of the United States Army, thus the text is reliable and up-to-date.

Chapters are devoted to the methods and sources of recruitment, the range of weapons from the machine gun to the megaton, the military threat presented by Communist powers and the US Army's response, the security stance of the US, the role of strike and support forces, battleteams and teamwork, training and education, modern "Minutemen", and the Army's future. The development of all these various matters are briefly traced from their beginnings, some from the early eighteenth century but most from the Great War 1914–18.

The roles of the strike and support forces, and the work of battleteams, are particularly well defined and give the reader a good insight to their organization and responsibilities, together with the range of co-operation they get from US Naval and Air forces.

The book is profusely illustrated and includes appendices which give tables of comparative ranks, commissioned, warrant or enlisted, for the Air Force, Army, Coast Guard, Marine Corps and Navy; also monthly basic pay rates, and monthly hazard pay rates for flying or submarine duty. This book would be an excellent primer for anyone who wished to obtain a good basic knowledge of the US Army, its organization, historical background and the role it is expected to play.

F.T.S.

## THE RED ARMY

#### By EDGAR O'BALLANCE

#### (Published by Faber & Faber. Price 30s)

Major O'Ballance has written a number of books on foreign armies; and The Red Army, now under review, may be regarded as a companion volume to The Red Army of China.

In a short Preface the author gives the reader a glimpse of the old Imperial Army before the Revolution of 1917; he then sets out to describe the formation of a new army from the ashes of the old. It is a complicated story, for Russia was at war with Germany at the time of the Revolution and continued fighting spasmodically well into 1918.

Meanwhile there were two rival governments. The Duma was a Provincial Government and the majority of serving officers were willing to give allegiance to it. The Petrograd Soviet of Workers' Deputies, as the name implies, was an outright revolutionary movement, which finally took control of the country.

Revolutionaries—unless they be military leaders at the head of a military *coup* always need to raise armed forces and the author describes how this was achieved, carrying on war against the Germans and fighting a Civil War, which was won by the Bolsheviks. It is not possible to trace the whole story here: the reader must follow it for himself. He will certainly be interested, and will see the emergence of such wellknown characters as Lenin, Trotsky and Stalin from exile to foremost places in the State. Many lesser, but still well-known figures also flit across the stage, and at the end of it all the reader will probably have a far clearer idea of how the events followed one another than before he began the book.

In 1920 the Russians were at war with the Poles, who with French assistance (directed by General Weygand) gave them a sound beating. An armistice was signed at Riga, and although the outcome of the war in the short view was disastrous, it had a long-term beneficial result for the Bolsheviks: it showed that the army was a national institution, as well as a revolutionary one, thus making it acceptable to many patriots who would not otherwise have supported Bolshevism.

Then followed what the author calls respectively The Period of Consolidation, 1920–8, and Expansion and Mechanisation, 1928–36. These two chapters follow the lines one might expect. Thereafter follows the Great Purge, which began in 1936 and ended only just before the outbreak of the Second World War. The author describes it as a "gigantic bloodbath, perhaps the biggest in history". It embraced every activity of the State, including the armed forces, where about 30,000 officers were executed or sent to concentration camps. The Red Army was, in consequence, in no position to derive from the Spanish Civil War (on the Republican side) the experience that the Nazis succeeded in deriving from participation on the other side. Nor was it in good fettle to tackle the war against Finland in 1939.

The war against Nazi Germany is not given very much space; but, as the author remarks in the Preface, the "reader would not be able to see the wood for the trees" if another treatment were adopted. Your reviewer agrees with this view, and considers that the author is justified in his treatment of the years between 1941 and 1945.

Finally there are chapters on Post-War Developments and The Soviet Armed Forces Today. These must to some extent depend on conjecture, and their accuracy is hard to test. Certainly they are clearly set out and easy to read.

Your reviewer commends this book as an interesting one that makes a comprehensible and extremely complex story.

M.C.A.H.

# AN INTRODUCTION TO CRITICAL PATH ANALYSIS By K. G. Lockyer

(Published by Sir Isaac Pitman & Sons Ltd. Price 18s)

It was inevitable that the great interest displayed in the Critical Path and similar methods of planning would result in a number of books on the subject. Mr. Lockyer is to be congratulated on producing the first in this country; it would be surprising if there are not several more published within a year or two. Until this book appeared recently, those wishing to study the subject of Critical Path planning had to resort to the various American publications, such as the reports on PERT by the Special Projects Office or the books by D. M. Stires and M. M. Murphy or J. W. Fondahl, all of which are not very easily obtained and are anyway rather difficult for readers to assimilate if they are not familiar with American planning jargon.

The present publication, on the contrary, has the great advantage that it is written in simple English, and that it is very readable. This is partly because Mr. Lockyer has directed his efforts at providing an introduction to the subject, rather than a comprehensive treatise on all the more sophisticated techniques available. As a result, the book is short (about 100 pages) and the price is low. Anybody working through the book would gain a good basic knowledge of the principles and elementary drills of Critical Path planning, and no previous knowledge of the subject is needed. The reader should not expect to be fully competent to apply Critical Path techniques to complicated projects directly after reading this book, but he can confidently expect to be able to understand the system well enough to know what more experienced planners are talking about. He will also be able to apply the basic drills to comparatively straightforward problems successfully, and if he does so he will soon gain a more complete understanding of the system. If, by then, there is no more advanced work published in this country, further study will have to be based on one of the American texts referred to by Mr. Lockyer in his bibliography.

This book starts, rather surprisingly, by covering the basic principles of both arrow diagramming and scheduling in an "Introductory" chapter; this is quite a good way of giving a very superficial and brief explanation of what the method is all about, but it does tend to blur the distinction between planning (sequencing) and scheduling: the separation of these two main steps is one of the great advantages of the system. In the second and third chapters the author goes back to the beginning again, and gives an adequate description of arrow diagramming. These two chapters are generally well argued and convincing, but one or two of the examples given are not entirely satisfactory and there is some lack of co-ordination between the text and the diagrams. A rather rigid approach has been adopted, and too much emphasis has been placed on the renumbering of events. Generally, however, these chapters cover the essentials well and state the necessary conventions and rules clearly.

Chapter Four introduced times to the diagram and shows how the Critical Path is isolated, but then digresses to describe the matrix method of solution; many readers will find this confusing or distracting, and may omit this section on the first reading or altogether. Chapter Five deals with float well and in some detail; there is, however, one mistake in the graphical summary of the types of float. The next chapter discusses the important aspects of reducing project time and the use of the cost-slope technique; this discussion is brief and rather superficial, but correct as far as it goes except for one mistake in a table of costs.

Chapter Seven describes a system for transferring the inter-relationships defined by an arrow diagram onto a Gantt chart. This system seems to be of doubtful value, as it attempts to combine two basically simple techniques, each with its own advantages (in planning and progressing respectively), into one system; many people will find this rather confusing, and this chapter may be omitted without affecting the reader's understanding of the Critical Path method.

The next chapter, on loading (resource levelling), is well written and interesting. It is not (and does not claim to be) a complete treatment of what is a large and expanding subject. The chapter on control of projects states the problem clearly and briefly, but again it is not very comprehensive in its treatment.

Chapter Ten gives the mathematical approach to duration uncertainty, which is the principle feature of Programme Evaluation and Review Technique (PERT) as opposed to the Critical Path method. This chapter is a clear description of the subject of duration uncertainty, but most readers will not need to devote much attention to it; the method is only applicable to development and similar projects, and even in this field there are very divided opinions on the value of the analysis of varying estimates of durations.

This book has a good bibliography and index, the print is clear and the diagrams are excellent. The straightforward style is well suited to the subject, which can easily become confusing to the novice. All-in-all, Mr. Lockyer has produced a very valuable introduction to the subject of Critical Path planning.

N.R.S.

#### SMALL WATER SUPPLIES

#### By S. McConnel, BSc (Eng), MICE

## (Published by Constable & Company, Ltd, 10–12 Orange Street, London, WC2. Price 30s)

This book provides the answers to problems confronting young, inexperienced engineers (military or otherwise) faced with the responsibility of providing water in fair quantity in tropical or sub-tropical countries without the aid of expert advice. Anyone with an elementary knowledge of water supply schemes should, with the aid of this book, be able to work out his requirements in terms of water, pumps, filtration equipment, controls, pipes, and storage capacity.

The author has omitted the theory of hydraulies and the principles of design applicable to pumping plant and its associated equipment; instead he keeps his mathematical references to a few simple formulae to illustrate the operational principles of water supply equipment, and includes a wealth of practical descriptive information on rainfall, natural sources, catchments, run-offs, evaporation, population and water consumption, afforestration, irrigation, gauging of supplies, fire supplies, pipes and pipelines, service reservoirs, filtration, softening and sterilization.

Mr McConnel has spent fifty years engaged on colonial supplies in tropical and sub-tropical countries and he illustrates his text with a number of diagrams and a great deal of useful data on systems developed in places as far apart as Australia and South Africa.

A list of books recommended for further reading is included at the end of each chapter.

This is a very useful book which might well be included as a standard textbook for the training of young engineer officers.

F.T.S.

### FUNDAMENTALS OF COST ENGINEERING IN THE CHEMICAL INDUSTRY

### By H. CARL BAUMAN

#### (Published by Reinhold Publishing Corporation. Price 108s)

This book, written by a Cost Engineer in the American chemical industry, deals with all aspects of costing a chemical installation. The author defines a Cost Engineer as "a recent designation for a professional engineer who has attained all the technical qualities of the design engineer, and in addition must be cost conscious with an extraordinary interest in finance, accounting and contract law".

The author has attempted to combine into one volume the preparation and comparison of estimates, cost codes, cost planning and capital costs. Some of the material has appeared in serial form in an American technical journal from 1958 to 1962.

Each of the fifteen chapters deals with some aspect of costing an installation whilst it is being designed, under construction, and in operation. The headings are: capital costs, the standard cost code, fixed capital cost estimation, equipment and installation costs, buildings and structures, auxiliary facilities, piping and insulation, electricals and instrumentation, complete plant costs, mechanics of estimating, short-cut estimation, fixed capital cost control, manufacturing cost estimation, profitability and construction costs abroad.

The chapter on buildings and structures shows an example of cost planning, and illustrates how the cost of a building is estimated by reducing all costs to an equivalent cost per sq foot of building floor area, using derived formulae for relating such factors as building width, height, number of stories, window area, etc.

Reference is made to scheduling techniques: Programme Evaluation and Review Technique (PERT), Programme Evaluation Procedure (PEP), Least-Cost-Estimating and Scheduling (LESS), and Critical Path Method (CPM).

The use of CPM in accelerating the completion of a project, and how the cost of the acceleration is assessed is explained. An example is given of the use of a computer in preparing a programme.

There is a summary at the end of each chapter of references for further study.

The book is well illustrated with numerous tables, diagrams and graphs. The material is good, it is, however, unfortunate for UK readers that all costing is in dollars. There are seventeen appendices, including a glossary of cost estimating terms, the remainder being tables giving the storage capacities of cylinders and spheres, conversion factors, surfaces, and volumes of solids, etc.

It is a text book produced specifically for the American Cost Engineer specializing in costing of the design, construction, maintenance, and manufacturing processes of the chemical industry, and will be of little, if any, interest to the military engineer.

F.C.

# PRINCIPLES OF DYNAMICS By Rodney Hill, FRS

(Published by Pergamon Press Ltd, Headington Hill Hall, Oxford. Price 42s)

The author of this work held the Chair of Applied Mathematics at the University of Nottingham, and it was written during a year's leave granted for study before he joined the Department of Applied Mathematics and Theoretical Physics at Cambridge University.

In the preface to his book the author states that his aim is to present classical dynamics primarily as an exemplar of scientific theory and method, and that he is convinced that this is educationally indispensable for the training of structural engineers, applied mathematicians and theoretical physicists.

#### BOOK REVIEWS

The book is divided into three Sections dealing respectively with gravitational theory of planetary systems, the general principles governing the foundations of mechanics and the general motion of a rigid body. The language and mathematics is not for the uninitiated, but the book would be of value to Degree students.

L.

# MATRIX METHODS OF STRUCTURAL ANALYSIS By R. K. Livesley, MA, PHD.

(Published by Pergamon Press Ltd, Headington Hill Hall, Oxford, for Robert Maxwell, мс. Price 275 6d)

This book is Volume Three of the Structures and Solid Body Mechanics Division of The Commonwealth and International Library of Science, Technology, Engineering and Liberal Studies. Its author is a Lecturer in Engineering and a Fellow of Churchill College, Cambridge.

The purpose of the book is twofold. Firstly, it shows how to use matrix notation to present the basic principles of structural analysis in a general, but compact way. Secondly, it provides practising engineers with an account of the analytical techniques for skeletal structures which experience has shown to be useful when programming problems for digital computers.

The text covers a general introduction to the subject; vectors and matrices; basic relationships and definitions; the equilibrium method; stiffness, flexibility and equilibrium matrices; connexion matrices and determinate systems; the compatibility method; transfer matrices; computational problems; and the analysis of non-linear structures.

The examples of the matrix methods given are used to illustrate particular points in the general theory and are not necessarily the most appropriate in practice, and the analyses are only worked out to the stages which are suitable for completion by standard methods on a computer.

This text-book is designed for students about to start their final undergraduate year who possess a mathematical background and a fair working knowledge of the more important techniques of structural analysis.

F.T.S.

# FOUNDATIONS OF ENGINEERING By Philip Sporn, ee

(Published by Pergamon Press Ltd, Headington Hill Hall, Oxford. Price 255)

In the early part of 1963 the author at the request of Dale Corson, then Dean of the College of Engineering, and now Provost of Cornell University, presented a series of lectures on "engineering and engineering fundamentals" and, except for only minor editorial changes, the lectures are recorded in full in this book.

How members of the University received the lectures is not known, but there is no doubt that career counsellors, teachers of engineers-to-be, and qualified practising engineers, at all levels in their professions, will find these lectures of outstanding interest. The author, a distinguished American engineer, has literally tossed his wig and a lifetime of engineering experience on the green in the cause of the philosophy of engineering against the modern tendency to regard anything other than pure science and scientific training as secondary importance.

In effect he opposes the recent changes in the curricula of colleges of engineering that have placed an emphasis on science—mathematics, physics, chemistry—with a resultant neglect of the basic principles of engineering. He says that the engineer qua teacher has begun to disappear from schools and colleges of engineering and is being replaced by scientists who, for all their knowledge, have never practised engineering nor really understand the basic broad functions of the engineer.

His six lectures which cover: The Philosophy of Engineering; Vision and Synthesis in Engineering; Dynamism in Engineering; The Obvious in Engineering; Energy in Engineering; Engineering in Energy; are full of challenging statements of his personal beliefs, as qualified by his own experience and some of the engineering "bloomers of the past".

His definition of an "engineer", as distinct from "technician" and "technologist", states that, apart from supervising the latter two on specific works, his concern extends beyond any particular technology, and he needs to visualize the social-economic or human needs and the methods for satisfying them more economically and more efficiently than has been accomplished in the past.

To illustrate his point that scientists often produce what he terms "specious scientific poppycock" he details, as one example of several, the real cause of the tragedy of the great bridge over the Firth of Tay in 1879 which, according to the designer Sir Thomas Bouch, was due to the Astronomer Royal, Sir George Airey, advising him to design his bridge to stand up to a maximum wind pressure over its whole extent of 10 pounds per square foot, thereby causing him to disregard his practical belief that he should design for a wind pressure of 34 pounds per square foot.

Many fascinating records of the past, and many thoughts for the present and future of engineers and engineering, are contained in these lectures, which offer a refreshing realm of thought for the study of engineers (and scientists) of any professional standing.

F.T.S.

# **Technical Notes**

### THE MILITARY ENGINEER

#### MAY-JUNE 1964

KOREAN INCENUITY IN CONSTRUCTION, by Lieut-Colonel Thomas T. Jones, Corps of Engineers, US Army. A well illustrated article describing how the contractors employed by the US Engineers in Korea overcome the lack of modern construction equipment. The article is of interest as it shows how much work is being carried out in that country by the US, but the methods described are familiar to anyone who has served outside Europe.

THE MILITARY ENGINEER AS ENGINEER-MANAGER, by Lieut-General Walter K. Wilson, Jr, Chief of Engineers, US Army. The Chief of Engineers describes how the work of the Corps of Engineers has grown in technical complexity since it became responsible for much of the construction work required by the Ballistic Missile Early Warning System, DFW Line stations guarding the Arctic approaches and the Inter Continental Ballistic Missile Launcher Bases. To these have been added work connected with the journey to the moon. Most of these tasks can only be carried out by teams of specialists from the various technologies working closely together under a single co-ordinator or Engineer-Manager. It has been found that the training and experience of the military engineer fits him ideally for this role. Part of the interest of the article consists in the summary of the main tasks on which the engineers are engaged.

AN INTRODUCTION TO DIGITAL COMPUTORS, by Glen L. White. This is a very good attempt to explain the inexplicable to a layman. The author does give a clear description of the various parts of the digital computor and what purpose they serve. He also gives an example of the way in which a computor would be used to make a selection from a number of items according to a required specification. How it does so is not made completely clear. It is doubtful if it would be possible to do so for the layman.

CATHODIC PROTECTION OF MISSILE EMPLACEMENTS, by Lieut-Colonel Lindsay M. Applegate, US Army (retd). Cathodic protection is the only available means for preventing corrosion on the deeply placed steel structures of which missile emplacements largely consist. In this article the author describes the methods used with a great deal of technical data and clear diagrams and photographs.

NEW ENGINEERING FRONTIER—THE DEEP OCEAN, by Comdr Charles Curione, Civil Engineer Corps, US Navy. The effects on materials of prolonged exposure in the deep ocean are being studied by the Naval Civil Engineering Laboratory (NCEL). This is part of a project for exploring the deep ocean which is considered to offer more prospects of advantage to the human race than any outer space journeys. There is a clear description of the structures used to hold the samples to be studied with a note on the difficult problem of mooring them and locating them for subsequent raising. So far studies have been carried out off the coast of California at a depth of 6,000 ft. The facts already discovered are described and the article is illustrated with photographs.

BRIDGING IN EXERCISE "BIG LIFT", by Captain Victor N. Tooth, Corps of Engineers, US Army. For this exercise an experiment was carried out in which bridging material was delivered to the site by helicopter. The floats were dropped onto the water just down stream of the construction site where power boats took over. The time factor which is given in the article is remarkable. A five float raft with the AVLB used as decking, all air delivered, took 25 min to assemble.

# THE ROYAL ENGINEERS JOURNAL

PREPLACED AGGREGATE CONCRETE TECHNIQUES, by Bruce A. Lamberton. The article begins with a description of the Montana Minuteman Missile Wing which consists of 150 missile launch facilities and fifteen launch control centres. The installations are dispersed over an area of 17,000 sq miles. Each launch facility consists of a reinforced concrete liner tube, a concrete angular equipment area surrounding the top of the liner and a reinforced concrete support building, all underground. The article describes how the work was carried out in considerable detail. The aggregate was packed in first and grouted with special cementing materials. The materials and quantities are given, and there are good illustrations.

SWIFT STRIKE III, by Lieut-Colonel B. P. Prendergrass, Corps of Engineers, US Army. A description with photographs and a good deal of detailed information on loads, etc, of the construction of an airfield to take C-130s bringing in all the equipment by air.

SURVEYS and MAPS. There is an interesting short article on the Crossing of the Cordillera in Bolivia with a triangulation. Most of the work was carried out at heights of 16,000-17,000 ft.

### MILITARY ENGINEER FIELD NOTES

ENGINEER BOAT PLATOONS IN VIETNAM, by Lieut-Colonel R. J. Roberts, Corps of Engineers, US Army. The Mekong River Delta in South Vietnam is a vast network of canals and small streams and the large number of communities are accessible only by water. Since this is a rich rice and other food producing area the communists are strong there. The article describes the organisation of platoons equipped with swimmer support hoats to operate in the area. The swimmer support boats are of special construction, described in the article, and are virtually unsinkable. They were introduced in 1962 and have been a great success. There are good photographs,

PREFABRICATED AIRBORNE BRIDGE, by Captain Freeman Cross, Corps of Engineers, US Army. A short account of how a twin-tread bridge was made up from parts of the standard M-4 bridge parts which was within the lifting capacity of a C-130 aircraft. The span was 54 ft. There are photographs and detailed specifications. J.S.W.S.

## CIVIL ENGINEERING

# Notes from Civil Engineering and Public Works Review, May 1964

UNIVERSAL BEAMS AS RUNWAY BEAMS. In the past, British Standard beams have been widely used as runways for overhead cranes, etc. The strength of the flanges of these beams considered as cantilevers springing from the web is more than adequate when compared with longitudinal bending and deflection. However, now that universal beams which have thinner flanges are likely to be used as runway beams, the strength of the flanges could be critical. This article derives a design method for universal beam sections and gives a table of safe working loads.

CABLE CANTILEVER BRIDGE AT NEWPORT. This article describes the bridge recently constructed over the River Usk at Newport, Monmouthshire. The main span consists of a cellular steel box deck cantilevered out from the piers and supported by high tensile steel wire ropes which are carried over cast steel saddles at three levels in the supporting towers. The pull is balanced by the dead weight of four of the approach spans. This is the first of this type of bridge to be constructed in UK and many problems, especially those concerned with balancing the cable tensions, required much research and model testing at the design stage.

A PURE RESISTANCE ELECTRICAL ANALOGUE FOR THE ANALYSIS OF PIPE NETWORKS. In the design of any pipe network, one is normally faced with so many variables that any calculations are laborious. This article describes a system whereby an electrical

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#### TECHNICAL NOTES

circuit consisting only of resistances is set up depicting the network under consideration. By adjusting the resistances, any set of circumstances can be represented and the current and p.d. indicate the flow and loss of head in any branch of the network.

MULTI-STACE TRIAXIAL TESTS ON UNDISTURBED SOILS. When testing soils to obtain the value of its cohesive strength and angle of shearing resistance, it is normal to test a number of samples in the triaxial test apparatus with the lateral pressure varied for each sample. The best tangent to the Mohr's circles obtained from these tests gives the values of the soil "constants". It has been suggested that time could be saved by using a multi-stage test, that is test one sample to incipient failure, remove the axial load, increase the lateral load and reload the specimen again to near failure point. This is repeated for the whole range of lateral pressures. The article describes research carried out to test the reliability of such a process and to compare it with the results from normal triaxial tests on similar specimens.

BEHAVIOUR IN FLEXURE OF REINFORCED LIGHTWEIGHT AGGREGATE CONCRETE BEAMS (PART 1). This article describes a series of tests carried out on twenty-eight rectangular reinforced concrete beams made from lightweight aggregate. It compares the actual ultimate strength with the calculated ultimate strength based on concrete crushing stress and steel yield stress. It also compares these values with CP 114 formulae for conventional gravel concrete.

# ICOLD (INTERNATIONAL COMMISSION ON LARGE DAMS) SUPPLEMENT

ROCK MECHANICS FOR DAM FOUNDATIONS. This is a very good general introduction to the fairly new science of rock mechanics. There is still a great deal of disagreement on many of the really basic problems and the article brings out the necessity for much more research to enable a better understanding of the problems to be achieved.

THE DESIGN AND CONSTRUCTION OF ROSEIRES DAM IN THE SUDAN. The economy of the Sudan depends very largely on the availability of water for irrigation. The Roseires Dam is an extremely large structure designed to double the existing amount of water available for irrigation with arrangements for additional storage in the future. The dam consists of an earth embankment 15 km long and a concrete buttress section of just over 1 km. As well as providing irrigation water, the scheme is designed to provide up to 175 MW hydro-electric power in the future.

THE AWE HYDRO-ELECTRIC PROJECT. Describes the work on the Nant and Inverawe sections of the Loch Awe scheme and gives many details of the tunnelling.

A CONTRACTORS COMMENTS ON SOME ASPECTS OF EARTH DAM CONSTRUCTION. This article emphasizes the need for a good site survey for an earth dam. A large proportion of the cost of such a dam is concerned with the construction of the cut off trench and the whole character of the contract can be changed if the information on which this work is planned is inaccurate or insufficient.

#### Notes from Civil Engineering and Public Works Review, June 1964

FIRST GENERATORS OF POATINA POWER STATION COMMISSIONED. In Tasmania, the consumption of electricity, per capita, is reckoned to be the second highest in the world. The article describes the Great Lake Power Development project and, briefly, other projects being undertaken by the Tasmanian Hydro-electric Commission. Interesting features are the Arthurs Lakes pumped storage scheme and the Mole tunnelling machine.

ANALYSIS OF GRILLAGES IN THE ELASTO-PLASTIC RANGE. This is the first part of an article on the use of computers for analysing frameworks in which some plastic hinges have been allowed to develop. It gives the theoretical background to the structural problem which was the subject of the computer programme.

REPEATED LOADING TESTS ON A 10-YEAR-OLD PRE-STRESSED CONCRETE BEAM. Ten years after a series of pre-stressed concrete beams had been manufactured and tested, all except one to destruction, the last beam was tested to compare its characteristics with those it exhibited ten years earlier and also the characteristics of the other beams. The article describes the tests and concludes that the small changes could all be attributed to the expected loss of pre-stress and there were no signs of deterioration with age.

"CYC-ARC" STUD WELDED CONCRETE ANCHORS. With the increased use of steel girders/concrete deck or floor composite construction, a really effective form of shear connector is required. The stud welded concrete anchors are now widely used as shear connectors and they are proving extremely useful in a wide variety of fixing problems. This article describes the equipment, tests results and design data and also gives examples of the uses of the welded anchors.

BRIDGE CONSTRUCTION ON THE HEADS OF THE VALLEYS ROAD. Describes the construction of three of the bridges for the section of the new heads of the Valleys Road between Hirwaun and Dowlais. Two of the bridges are concrete spandrel arch bridges and the third is a three-span continuous pre-stressed concrete bridge (constructed as an *in-situ* pre-stressed cantilever bridge similar to the Medway bridge until closed at the centre line and abutments). For the spandrel arch bridge, normal falsework would have been uneconomic and a cable cantilever system was used. In this, the arch was constructed out from the abutments in sections with the formwork cantilevered off the completed construction while the stresses in the arch were corrected by using suspension cables anchored back to a temporary tower constructed on the bridge deck immediately over the arch springing.

BEHAVIOUR IN FLEXURE OF REINFORCED LIGHTWEIGHT AGGREGATE (LYTAC) CON-CRETE BEAMS (PART 2). Completes the article the first part of which was included in the May issue. This part gives a summary of the characteristics of Lytag concrete and discusses suggested design rules.

THE MOVEMENT OF SOIL BENEATH MODEL FOUNDATIONS. This is the first part of an article describing a series of model tests to investigate the mode of failure of foundations. The model consisted of a loaded bearing plate on sand in a glass sided narrow box. Two cameras were arranged to photograph the movement of the soil in the box, one fixed and one connected to the loading system so that it moved with the bearing plate both cameras taking long exposures. Comparison of the photographs from the two cameras gives a clear indication of the soil movements as the load is increased.

D.F.M.





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